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(54) Web winding machine and method.

(57) A surface winder is provided for developing rolls of web material wound on a core including a magazine for dispensing cores sequentially and a nip for receiving cores sequentially, the core transport means between said source and nip arranged to follow a generally hypocycloidal path to provide cusps for adhesive application to the core and for introducing cores into the nip, a surface winder including a pair of winding belts traveling at different speeds and in different directions, and web severance means including a pair of web pinching points one of which is on the moving web and the other on a stationary part of the web.

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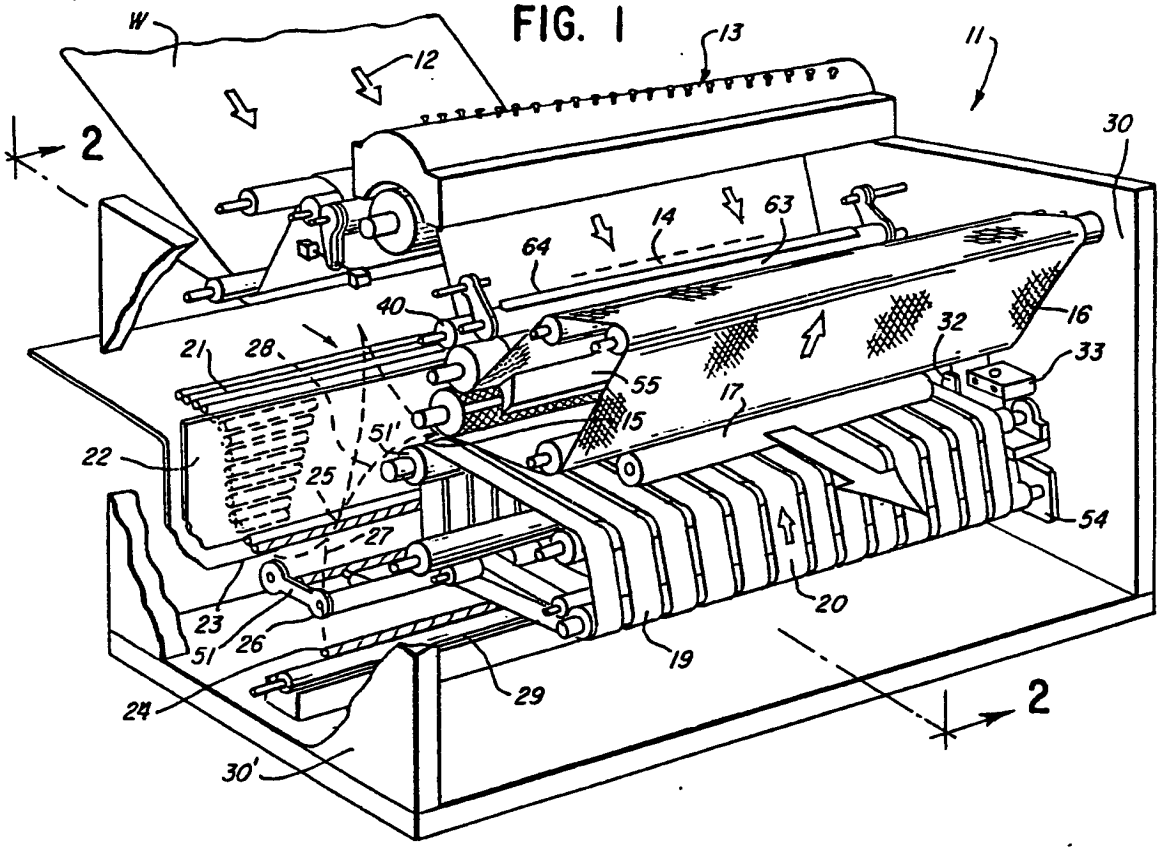
FIG. 1


W
12
13
11
2
30
14
63
64
40
16
32
21
28
33
55
17
15
51'
22
25
54
27
20
23
26
51
19
29
24
2
30'

WEB WINDING MACHINE AND METHOD

This application is a continuation-in-part of my co-pending application Serial No. 724,180 filed April 17, 1985.

BACKGROUND OF THE INVENTION

This invention relates to a method of web winding and machine therefor and, in particular, to a surface winder.

In web winding there are two basic methods for winding a web on a series of cores. These are center winding and surface winding. In center winding, a core is mounted on a mandrel which rotates at high speed at the beginning of a winding cycle and slows down as the diameter of the log being wound builds up.

In surface winding the core and web being wound thereon are driven by contact with belts, rotating rolls, or the like, which operate at or near web speed.

Illustrative of belt surface winding in U. S. Patent No. 3,148,843. More recently, the art has gone to rotating cradle rolls as illustrated by U.S. Patent 4, 327,877.

SUMMARY OF THE INVENTION

While core inserting systems are known for surface winders, the invention provides a unique core transfer/ feeder system based on hypocycloidal motion. This motion yields a precise and repeatable core insertion which can be advantageously employed in prior art machines as well as the dual belt surface winder described herein.

DESCRIPTION OF THE DRAWINGS:

The invention will be explained in conjunction with an illustrative embodiment shown in the accompanying drawings, in which --

FIG. 1 is a fragmentary top perspective view of the inventive machine from the product discharge end;

FIG. 2 is a sectional view taken along line 2-2 of FIG. 1;

FIG. 3 is an enlarged fragmentary view of FIG. 2;

FIG. 3A is a fragmentary view constituting a modification of FIG. 3;

FIGS. 4-8 are schematic views illustrating the sequence of web transfer;

FIG. 9 is a sectional view of one end of a core feeding device viewed essentially along the line 9-9 of FIG. 2;

FIG. 10 illustrates a portion of the core feeding assembly viewed along line 10-10 of FIG. 9;

FIG. 11 is a schematic side elevational view of a modified form of surface winder;

FIGS. 12-15 are enlarged fragmentary views of the central portion of FIG. 11 and illustrate the sequence of web cutoff and transfer;

FIG. 16 is a fragmentary top plan view taken along the line 16-16 of FIG. 11;

FIG. 17 is a schematic view of the drive system for the winder of FIG. 11;

FIG. 18 is a schematic side elevational view of a modified form of machine embodying a different surface winder but utilizing the hypocycloidal core feeder;

FIG. 18A is a fragmentary view of the central portion of FIG. 18 showing a further modification; and

FIG. 19 is a schematic side elevational view of yet another modification embodying a different core feeder with the dual belt winder.

DETAILED DESCRIPTION:

Operation in General

Referring to FIG. 1, a rewinder or web winding machine 11 processes a web W in the direction of arrow 12. After processing it through a perforator 13 which puts transverse lines of perforation 14 across the web, the web is transferred through a series of rolls and finally is transferred to a preglued core at the nip position 15 --see also the core C at the lower left in FIG. 3.

It is subsequently wound between an upper belt system 16 which contacts the top of a web-wound core (ultimately the log 17) which moves along a path in the direction of arrow 18 --see the

right hand portion of FIGS. 2 and 3 —and a lower belt system 19 which moves in the direction of arrow 20 at a different speed which is less than the speed of upper screen belt system 16. The belts are advantageously driven through the rolls which define nip 15.

A series of cores 21 (see the left hand portion of FIG. 2) is fed through a chute 22 to position 23 from which the cores are transferred by two assemblies which travel in a three-cusp hypocycloidal motion, as shown by the dotted lines 26, 27 and 28, to the nip position 15. Referring to FIG. 2, the core transfer device with the just-mentioned hypocycloidal motion picks up a core at position 23 and transfers it to position 24 where it comes into contact with a roll 29 having glue on its surface. The roll 29 is arranged to apply an interrupted line of adhesive to the core.

The first assembly with hypocycloidal motion then moves the core from position 24 to position 25 where it is transferred to, and is then under control of, a second assembly with hypocycloidal motion. The second assembly grips the core between glue segments and moves the core from position 25 to the nip position 15. The nip 15 is approximately equal to the outside diameter of the core and represents the minimum distance between upper belt system 16 and lower belt system 19.

Prior to this instant, the perforated web is carried forward around a series of rolls until it contacts the line of adhesive on the core and is thus transferred to the core. The now-rotating core and web being wound move from position 15 in the direction of arrow 18 until the log is completely wound, as at position 17 —see FIG. 1. Conventional equipment can be used for transferring the wound logs to subsequent operations, such as cutting into individual consumer size rolls, wrapping and cartoning.

Upper and Lower Belts Generally

The perspective view of FIG. 1 also shows that the upper screen belt system 16 and associated rolls are generally cantilever mounted on one side frame 30. Thus, the upper belt system is not movable, but the screen can be removed and replaced from one side. Likewise, the lower belt system 19 - (having a plurality of belts and associated parts) is generally cantilever mounted on a subframe (not shown) which is vertically movable on slide shafts 31, 32 (see the lower right hand portion of FIG. 2). Blocks 33 mount shafts 31 and 32 securely to side frame 30. Thus, the lower belt system can be adjusted up or down relative to the fixed upper belt system, and the gap therebetween can be varied to compensate for differences in core diameter.

The front or operating side of the machine has a side frame 30', illustrated only fragmentarily and at the lower left in FIG. 1. This frame is cast with openings to remove the two belt systems. It also provides a means for mounting upper and lower brackets 34 and 35 —see the central right portion of FIG. 2. The brackets 34 and 35 serve as the means for supporting the cantilevered sides of the two belt systems 16 and 19.

Still referring to FIG. 2, it will be seen that the upper belt front support includes a first jack screw 36 extending downwardly from bracket 34. This engages the upper end of a transverse beam 37 which is the main support member for the upper belt system 16.

Extending downwardly from beam 37 is a second jack screw 38 which is threadably received in beam 39 —the one that carries the lower belt system 19. Extending downwardly from beam 39 is a third jack screw 40 which, at its lower end, is threadably received in rotary jack 41 mounted on bracket 35.

The upper beam 37 is rigidly mounted on the rear frame 30 and the lower beam is slidably mounted relative to the rear frame 30 on the aforementioned slide shafts 31, 32. Thus, by removing the three jack screws 36, 38 and 40, the front end of each of the beams 37, 39 is unsupported and the upper and lower belts may be removed and replaced.

Upper Belt System Details

The upper beam 37 is equipped with a pair of longitudinally-extending wings —longitudinal in the sense of the direction of web travel in the machine. These wings 42, 43 (see the central right hand portion of FIG. 2) support the various rolls that carry the upper belt.

Since the upper screen is of a width corresponding to web W, it is desirably guided. For this purpose, idler roll 44 is arranged with one journal mounted in a commerically available "cocking" device and which skews the roll as a function of a screen edge guide sensor (not shown). In this fashion, the full width screen is guided around the multi-roll assembly. Upper roll 45 is supported on each end by bearing blocks 46 which, through jacks 47, are movable in either direction at the urging of pneumatic pillows 48. To insure parallel movement of the roll 45 relative to idler roll 49, pinions 50 are mounted on a common

ross shaft. The other roll associated with the upper screen belt assembly is a vacuum transfer roll 51 operating in conjunction with vacuum chamber 52, both of which are supported from the main upper beam 37 through the wing 42.

Lower Belt System Details

As mentioned previously, the support for the lower belt system is the transverse beam 39. This is adjustable vertically by means of rotary jacks 41 (front and rear). The beam 39 likewise carries a pair of longitudinally extending wings 53, 54 which carry the various supporting rolls. Through the operation of jack screws 38, 40 the height of the beam 39 can be varied, thereby adjusting the distance between the upper and lower belt system. The rotary jacks are employed for aligning the ends of the beam 39. The lower belt is advantageously driven through the lower roll 51' of the nip 15.

To compensate for different finished roll diameters, the roll 55 (indirectly carried by the wing 54) can be adjusted vertically. This is achieved by further rotary jacks 56 mounted on the wings 43. Here it will be appreciated that, for the sake of clarity of presentation, only the front wing has been shown, but in accordance with established machine practice, similar supporting means are provided on the rear side.

Referring now to the upper left portion of FIG. 2, the major components in the web path first include a web draw roll section generally designated 57. Provided as part of this section is a spreader roll 58 and two co-acting draw rolls 59, 60 which have an adjustable nip and can be variable speed controlled. The perforating component 13 includes a perforating head having anvils mounted therein and a perforating roll 61 which has perforating blades, generally as seen in U.S. Patent No. 2, 870,840.

The cutoff and transfer section includes four rolls consisting of a roll 62, a pivotable cutoff roll 63 having blades 64 mounted therein, an anvil-bedroll 65 and the transfer roll 51. Details of the cutoff and transfer section are shown in FIG. 3, the details of the transfer sequence are shown in FIGS. 4-8.

Cutoff and Transfer

FIG. 3 is an enlarged view of the cutoff and transfer roll assembly shown in FIG. 2. Web W wraps roll 62 which is driven at web speed and roll 62 may be in contact with anvil roll 65 if desired. When the web passes roll 62 and is entrained on the surface of roll 65, it bridges slot 66. The cutoff roll 63 mounted to pivot about shaft 67 is arranged with the blade 64 extending radially outward of its periphery. When slot 66 is rotated to about the two o'clock position as shown in FIG. 3, roll assembly 63 is pivoted downward so blade 64 will puncture the web and produce a free leading edge. Vacuum from an external source (not shown) is applied to concentric slot 68 of an external vacuum manifold. By use of inserts 69 and 70, which are adjustable, that portion of the concentric slot 68 extending clockwise from line 71 to line 72 is vacuumized. Details of the external vacuum manifold are well known and are generally described in co-owned Patents 3,490,762 and 3, 572,681.

While roll 65 rotates from position 71 at about ten o'clock until it reaches line 72 at about five o'clock, vacuum manifold slot 68 communicates with the transverse vacuumized passage 73. Through a series of radial ports 74 aligned transversely across the face of roll 65 and directly behind slot 66, vacuum is provided to control the leading edge of the severed web segment. This leading edge is held on the periphery of roll 65 by vacuum until it reaches line 72 at the five o'clock position and from there until about the seven o'clock position at line 75, it will be entrained on the surface of the roll 65 by the upper screen belt 16.

Vacuum chamber 52 which includes transfer roll 51, has an upper lip 76 which extends to about the four o'clock position relative to roll 65 and serves to limit the extent of vacuum chamber 52 at that location, as shown. This permits the vacuum in chamber 52 to act upon the web W before it leaves roll 65 ensuring reliable transfer of web W onto the upper screen belt 16.

Transfer roll 51 is essentially a hollow roll with a series of holes or apertures 77 in the surface thereof. Advantageously, commercially available materials such as expanded metal grating or other apertured metallic plates, can be used for the porous surface of roll 51. It is noted that a strip 78 installed parallel to the axis of the roll does not permit vacuum to be effective in arcuate portion 79 on the surface of roll 51.

When the leading edge of the cut web, carried on the upper screen belt 16 by vacuum from chamber 52, approaches roll 51 at about 12 o'clock, it is matched with the leading edge of strip 78 so that a portion of the cut web, approximately equal in length to strip 78 is not held onto screen belt 16 as it wraps around roll 51. This leading web portion, from leading edge to the trailing edge of strip 78 folds back onto the following portion of the web which is securely held against screen belt 16

as it wraps around roll 51 by the vacuum in chamber 52. This fold back occurs during the movement of strip 78 from 12 o'clock on roll 51 to 6 o'clock where the nip 15 is formed so that fold back is present at the instant of transfer of a new core at nip 15. The length of the fold back is determined by the length of strip 78. Fold back is not necessary for single ply webs but is advantageous with webs of two or more plies.

At the instant the leading edge of folded portion reaches the six o'clock position, a core C is inserted as shown in phantom and is instantly trapped in the nip between upper belt 16 and lower belt 19 as shown in position 15. As soon as the core contacts both upper and lower belts, it begins to rotate in a clockwise direction and almost instantaneously, the velocity of its surface equals web speed. If both belts were traveling at the same velocity, but in opposite directions as shown , the core would remain stationary directly below the six o'clock position of transfer roll 51. However, the velocity of lower belt 19 is less than upper screen belt 16, and this difference in belt velocities results in movement of the core and the roll being wound successively from nip position 15 this movement of the progressively wound log being in the direction of arrow 18.

FIGS. 4-8 show the transfer of reverse folded web as it approaches nip line 15'. There it contacts core C with glue stripes 80, is glued (see FIGS. 5 and 6) as it begins to rotate downwardly and as it rotates past bottom belt contact point 19 (FIG. 7). In FIG. 8, the leading edge of the web is secured to the core by glue stripe 80 by completing one wrap and is thereafter trapped by oncoming web segment until the winding process is completed, analogous to co-owned Patent Re. 28,353.

It will be recognized that the multiple apertures 77 result in a very porous surface of transfer roll 51 which, at the same time, allow high flow rates through that portion of the porous surface that is enclosed within the extended lip portions of vacuum chamber 52, (see FIG. 3). While other arrangements are possible, hollow construction with a porous surface of roll 51 is preferred, since the arrangement shown makes possible the use of continuous vacuum as opposed to very costly and complicated vacuum systems that require cycling vacuum pressures. This is particularly advantageous in achieving high speeds and also in overcoming the normal difficulty in obtaining uniform vacuum across a roll, especially when wider machines are involved.

Core Transport and Feeding

The core feeding section generally designated 81 includes two rotating assemblies 82 and 83 --see FIG. 2. Each develops a three-cusp hypocycloidal motion which is advantageous in transferring the core from the pickup position 23 --see FIG. 2 --to the gluing position 24, a transfer position 25 and a nip insertion position 15. Details of this particular mechanism are seen in FIGS. 9 and 10. Each of the assemblies 82 and 83 are similar in construction and motion, but are dimensioned differently for this particular arrangement. For example, a rotating vacuum roll 84 (see left bottom corner of FIG. 2) --rotates about shaft 85 in an orbit 86 shown in phantom. Upper transfer assembly 83 has a similar rotating vacuum roll 87 rotating about axis 88 in an orbit 89 --also shown in phantom.

Essentially, the lower transfer assembly 82 picks up cores at position 23 and moving through a hypocycloidal path, moves the core to position 24 where an interrupted axially-extending glue line is applied by glue roll 29, and subsequently moves the core to position 25. The core is held on the transfer assembly by vacuum. With the hypocyclodial motion, it is noted that a glue line printed on the outside of the core at position 24 shows at transfer position 25 as a glue line in position 90 -- see FIG. 2. At position 25, vacuum on the lower assembly is shut off and the vacuumized roll 87 on the upper transfer assembly takes over control of the core and moves it to the nip position.

The hypocycloidal motion of the core is achieved in the illustrated embodiment by orbiting a vacuum roll 84 about the axis of shaft 85 (see FIG. 2) --while at the same time rotating the roll 84 relative to arm 91 --see FIG. 10. The arm 91 is rotatably mounted on shaft 85. In FIG. 9, certain parts are stationary and include the shaft 85 keyed to side frame 30, and an attached pulley 92 also keyed as at 93 to shaft 85. A vacuum valve 94, having a concentric vacuum manifold 95, is attached to the stationary frame 30 via bolts 96. Thus, it too remains stationary.

The moving parts include pulley 97 rotatably mounted on shaft 85, being driven by belt 98 from an external source and synchronized with cutoff and transfer. The arm 91 is secured to pulley 97 and carries vacuum connecting pipe 98 and sleeve 99 to rotate about shaft 85.

The end of arm or bracket 91 supports bearing 100, roll journal 101, pulley 102 attached thereto and vacuum roll 94. While these parts also orbit, they rotate relative to arm 91 due to action of belt

103 which is entrained around fixed pulley 92 and pulley 102. The diameter of pulley 92 is three times that of pulley 102 which thus produces the three cusp hypocycloidal motion.

The rotation of pulley 102 causes vacuum roll 84 to rotate and with it vacuum pucks or nozzles 104 and core C --about an axis provided by journal 101. This combined motion results in the center of the core tracing a hypocycloidal curve --see phantom lines FIGS. 1 and 2 similar to that provided in co-owned Patent 3,994,486.

Referring to FIG. 9, stationary vacuum valve 94 bears against finished surface 105 of the rotating arm 91. The circular vacuum manifold 95 contains inserts 106, 107, which are spaced apart and define a vacuum zone V. This zone is vacuumized through an external connection 108 leading to a vacuum source (not shown).

Vacuum applied through pipe 108 communicates with the circular manifold 95 and when the opening 109 of pipe 98 communicates with vacuum zone V, vacuum is transmitted through vacuum pocket 110 of sleeve 99 to the central hollow chamber 111 of roll 84 through a series of ports 122 which communicate with pocket 110. In this manner, vacuum can be applied to the axially-spaced vacuum pucks over a selected portion V of the orbit in any predetermined or programmed manner and as vacuum force is needed to pick up, hold and release the cores.

Operation of Core Transport

To achieve the hypocycloidal motion of the core, it is orbited about the axis of the fixed shaft 85 or 88 while being revovled about the axis of the core transport roll 84 or 87. In the illustration given, there are three revolutions per orbit but any other integer number can be used, depending upon the geometry of the system. It will also be apprecaited that gears or other transmission couplings may be employed in place of the first pulley means 97, 98 for rotatating the arm 91 to orbit the core transport roll 84 or 88 and the core C --and in place of the second pulley means 92, 102, 103 for rotating the core transport roll 84 or 88 to cause the core C to revolve around the core transport roll 84 or 88. The core C is offset from the axis of the core transport roll 84 or 87 by the use of generally radially extending puck means 104.

The cores are sequentially engaged and released, in the illustration give, by vacuum. However, depending upon the system geometry, other engaging/disengaging means may be employed such as pins or grippers on the core engaging member 84 or 87. Vacuum is preferred because it minimizes the use of moving parts.

For example, the only movement in the vacuum system illustrated is that of the vacuum pipe 98 past the vacuum manifold 95 (see FIG.. 9) and the rotation of the ports 112 past the sleeve 99. Limiting the effect of the vacuum --and thereby the ability of the puck means 104 to maintain the cores in engaged relation --is readily achieved by blocking off parts of the manifold 95 by the inserts 106. The location of the inserts thus programs the clamping and unclamping of the cores by the core transport roll means 84, 87.

Also in the illustration given, I make the orbit 89 substantially larger than the orbit 86. This permits the use of longer puck means 104 and thereby develops a longer, narrower cusp to facilitate insertion of the core into the nip 15. It also means that the puck means 104 are equally quickly retracted from the vicinity of the nip so as not to interfere with the winding of the roll being wound.

Reference is now made to FIG. 3A which shows a modified form of the belt surface winder and focusing on the parts thereof originally described with respect to FIG. 3. The essential difference between the showing in FIG. 3A from that of FIG. 3 is in the core insertion nip which in FIG. 3A is designated 15a. Reference to FIG. 3A shows that the lower roll 51'a has been displaced down stream from the location of FIG. 3 and the core insertion nip 15a is now developed by the upper roll 51a and a stationary plate 217a. The purpose of providing the stationary plate 217a is to get the core C away from the core inserting mechanism more rapidly. The core inserting mechanism is depicted only schematically by the fragmentary cusp designated 28a which is the path followed by the center line of the core when the same is supported by the vacuum puck means 104. This results in a simplification of the core inserting means 81 because there does not have to be quite as a rapid a withdrawal of the vacuum puck means 104.

Also in this connection it will be noted that there are two nips provided, in effect. There is the core insertion nip 15a and then downstream a short distance therefrom a second nip, the belt system nip 223. The nip 223 is that developed between the cooperative action of the upper and lower belt systems. In the embodiment of FIGS. 1-10, the single nip 15 accommodated both the function of

core insertion and the initiation of the double belt system winding. In this modification, the first nip 15a still accommodates the core insertion function but the second nip 223 is the one that accommodates the initiation of double belt system winding.

-MODIFICATION OF FIGS. 11-17 -

A simple yet advantageously effective modification of the surface winder of the type just described is illustrated in FIGS. 11-17. It is simple because it eliminates the following:

(1) the mechanism which cuts off the web before transfer which consists of two driven rolls and a complex cam mechanism for moving one of the rolls for cutoff;

(2) the vacuum pump and system which carries the cutoff web to the point of transfer to the new core;

(3) the upper vacuum screen and guiding system; and

(4) one of the two hypocycloial core handling mechanisms.

Reference is now made to FIG. 11 which shows the modified rewinder at the moment when the log being wound is finished and a new core has been inserted into the transfer nip.

The web W enters the machine at the left after being unwound from a parent roll (or parent rolls) and processed by embossing, laminating, printing, etc. It wraps draw rolls 201 nd 202 which feed the web to the perforator roll 203. Draw roll 202 is normally located at 9 o'clock relative to the perforator roll 203 but in this case is is moved to about 7 o'clock to provide access to the perforator roll surface (7 o'clock to 10 o' clock) for changing perforator blades. The perforator roll 203 contains flexible perforating blades which perforate the web by acting against anvils in the stationary perforator bar 204. Blades and anvils are now shown in order to simplify the sketch.

The web then wraps idling guide roll 205 and driven roll 206, and continues onto the log being wound 207, passing through the core insertion nip 208 --see FIG. 12 which shows the web path just after roll 206 in larger scale. The log being wound 207 is held firmly between upper belts 209 and lower belts 210 which cause both rotation/winding of the log being wound and also horizontal movement of the log being wound from transfer to completion during the winding cycle. The surface speed of roll 206 and the speed of upper belts 209 are the same and very close (+0% to +5%) to web speed which is set by draw rolls 201 and 202 and perforator roll 203.

The speed of the lower belts 210 is less than the speed of the upper belts 209 by an amount which causes the log being wound to reach position 207 (approximately) at the completion of winding. This speed difference is about 3% to 10% of web speed, and it is adjusted, by the operator, to match the length of web in the finished log (see FIG. 17 which is a Drive Schematic). In FIG. 17, the following symbols are employed:

"CW" refers to clockwise rotation

"CCW" refers to counterclockwise rotation

"B" refers to belt drive

"TB" refers to timing belt drive

"CH" refers to chain drive

"G" refers to gear drive

"VS" refers to variable speed drive

"M" refers to motor

The upper and lower belts 209 and 210 are actually several narrow belts (5-6 inches wide) which are close together (1-2 inch gap between belts) and cover the entire web width. The gaps between the upper belts are centered opposite lower belts and vice versa so the entire width is covered by at least one belt during winding.

Rolls 211 and 212 establish the working line of upper belts 209. Roll 212 is the drive roll. Roll 211 is adjustable toward roll 206 to adjust the core insertion nip 208, to match core diameter (1/2 inch to 2 inches range). Roll 212 is in a fixed position which is not adjustable. Rolls 213 are several rolls, one for each belt or upper belts 209, and they are air or spring loaded against their belts to act as belt tighteners and hold all belts at equal operating tension.

Rolls 214 and 215 establish the working line of lower belts 210. Roll 214 is the drive roll, and it is also adjustable vertically to match core diameter. Roll 215 is adjustable vertically to match finished log diameter (2 inches to 6 inches is usual range). Rolls 216 are several rolls, one for each belt of lower belts 210 and they are air or spring loaded against their belts to act as belt tighteners and hold all belts at equal operating tension.

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A stationary plate 217 spans the distance from roll 206 to the belts on roll 214. The core, with the initial wraps of web after transfer, rolls along stationary plate 217, driven by upper belts 209. The stationary plate is adjustable vertically to match core diameter.

FIG. 11 shows the 3-cusp hypocycloidal core handling mechanism 218 which is preferred because it uses only continuous, steady, rotary motions --no cams, cranks, or linkages. With the 12 inch diameter mechanism shown in FIG. 11, the maximum acceleration of the core is only 2.5 G's at 60 logs per minute (LPM) which is quite gentle, reasonable, and acceptable. The acceleration is only 5.5 G's at 90 LPM which is also acceptable and reasonable.

Core handling mechanism 218 makes one revolution (cycle) per finished log produced, moving through paths 226, 227 and 228 defining cusps 226a, 227a and 228a. As seen in FIGS. 12 and 13, during that revolution (cycle) the mechanism 218 holds and carries the core by means of vacuum puck means. In this embodiment, a continuous stripe of adhesive is laid down and opposite to the side engaged by the vacuum puck means so that a continuous puck can be employed. The mechanism performs 3 tasks during each revolution - (cycle).

(1) It picks up a new core from the one-at-a-time core escapement wheels 219. The vacuum in the core carrying arms is turned on shortly before the pick-up action.

(2) It presses the core against glue roll 220, which turns slowly in a pan of transfer glue so its surface is always covered with a film of fresh glue. Glue roll 220 turns constantly at fixed speed independent of machine speed (see FIG. 17). This action puts a line of transfer glue on the core at the correct location of transfer (see FIGS. 12, 13 and 14).

(3) It inserts the glued core into the core insertion nip 208 between rolls 206 and 211 at the correct moment in the winding cycle, synchronized with the perforator and pinch-plate mechanism 221 to break and transfer the web onto the new core with exact, constant, sheet count per log. The vacuum is turned off at the moment the core enters the transfer nip 208. These actions of pick-up, gluing, and inserting are sequential and the sequence is repeated every product winding cycle. FIG. 11 shows mechanism 218 in all three operating positions in order to show these positions on a single sketch.

The mechanism 221 is the pinch-plate mechanism. Its function and purpose is to pinch the web W firmly against the upper belts 209 at the moment of web-break (see FIG. 14). The mechanism is arranged and located so that the distance between point A, where the pinch-plates pinch the web against the upper belts, and point B where the core pinches the web firmly against stationary plate 217, is less than twice the distance between two lines of perforation. It is timed to core insertion and perforation so that the specific line of perforation P to be broken lies intermediate, i.e., about mid-way between points A and B in FIG. 14. The surface speed of the pinch-plates is the same as the speed of the upper belts 209. At point A, the web is moving between the pinch-plates and upper belts at full web speed. At point B, the web is stationary/stopped between the core and the line of perforation P between A and B breaks. This yields:

(1) Exact sheet count in each finished log.

(2) Clean web-break at a line of perforation.

(3) A short bit of web (about 1/2 the distance between A and B) folded back around the core; a relatively neat and attractive transfer quality.

(4) Reverse-fold foldback around the core which traps both plies of 2-ply webs. FIG. 16 is a view looking vertically downward from above the centerline of the shaft 222 of the pinch-plate mechanism. On the shaft 222 there are several radial arms (one for each belt of upper blets 209) each of which carries a curved pinch-plate which is as long axially as its matching belt is wide. The stationary plate 217, contains an H-shaped hole for each radial arm. These holes allow the pinch-plates to pass through the stationary plate yet the holes are small (narrow) enough not to disturb the web winding around the core as it rolls over the holes. The pinch plates pass through the legs of the H while the radial arms pass through the cross bar of the H shaped opening.

Pinch-plate mechanism 221 rotates continuously during the entire winding cycle so it pinches the web against upper belts 209 several/many times yet it does not disturb the web flow/winding or break any perforations except at the precise mo-

ment of web-break and transfer; once per log. This situation/condition exists because:

(1) Roll 206 is located so that the web path lies on the lower surface of upper belts 209 - (see FIG. 12), viz., the upper surface of roll 206 is aligned with the surface of the lower run of belts 209.

(2) The surface speed of the pinch-plates is the same as the speed of the upper belts 209. The circumference of the circular path of the surface of the pinch-plates is equal to an integer number of sheets times the distance between the perforation lines which define those sheets.

FIGS. 11-16 show a pinch-plate mechanism with a circumference of 45 inches (10 sheets x 4-1/2 inches per sheet). This means that the number of sheets in a finished log must be some integer multiple of 10 (100, 130, 210, etc.). Other pinch-plate mechanism sizes are entirely feasible, but they must meet several design criteria:

(1) Circumference of the circular path of the surface of the pinch-plates equals an integer number of sheets times the length per sheet,

(2) Distance between A and B in FIG. 14 less than two times sheet length. In the U.S. this is less than 9 inches on toilet tissue which is the most demanding application. Less demanding is the European product which has a typical sheet length of 140 mm. (approximately 5-1/2").

(3) Surface speed of the pinch-plates equals speed of upper belts 209 and web speed.

(4) Perforator and pinch-plate mechanism are synchronized so perforator creates N lines of perforation per revolution of the pinch-plate mechanism where N is the integer number of sheets in the circumference of the circular path of the surface of the pinch-plates.

(5) Radius of pinch-plate mechanism (from center line of shaft to outer surface of pinch-plates) must be large enough to accommodate and include:

(a) Core diameter

(b) Shaft radius

(c) Stationary plate thickness For example, within these design criteria a circumference of 22-1/2 inches (5 sheets x 4-1/2 inches per sheet) is feasible. This permits the number of sheets in a finished log to be some integer multiple of 5 (95, 135, 215, etc.). This will be very advantageous for many applications where multiples of 5 sheets in the finished product is desired.

FIGS. 12-15 show what happens in a very brief instant from just before the core is inserted into core insertion nip 208, until the glue line on the core picks up the web and winding begins.

The time from FIG. 13 to FIG. 15 is a rewinder running 3000 FPM is only about 5 milli-seconds.

(1) The core with its glue line approaches the core insertion nip 208 which is adjusted to be less than the core diameter in order to pinch the core firmly in the nip.

(2) The core is firmly pinched in core insertion nip 208 and it is moved at web speed through the nip by the surfaces of roll 206 and upper belts 209 wrapping roll 211 which are both moving at web speed and in the same direction.

(3) The core rolls onto stationary plate 217 pinching the web firmly against the stationary plate at point B and stopping the web motion. The perforation P between A and B breaks.

(4) The core continues rolling on stationary plate 217 until the glue line lies between the core and the severed web (about 6 o'clock on the core in FIG. 15). The glue picks up the web to start winding. Radial acceleration of .web and glue at pick-up/transfer is one-fourth that of prior art winding machines. The web behind the core (to the left of glue contact with web) continues to feed creating a slack web (zero tension) which lasts during the first wrap around the core.

(5) The core, with the initial wraps of web, rolls rapidly to the nip 223 between the two slightly divergent, co-acting belt systems 209 and 210. More particularly, this nip 223 is provided with roll 214 and upper belts 209. This is where the horizontal motion of log being wound slows substantially and "double-belt" winding begins and continues until the log is completed as at 207. At 3,000 FPM, the time from FIG. 13 until the core

reaches 12 o'clock relative to roll 214 (nip 223) is only about 63 milli-seconds (about 38 inches of paper). There are several unique features in this transfer and cut-off/web-break concept.

(1) Web fold-back at the core is "reverse" fold which traps both plies of 2-ply webs and makes high speed (3,000 FPM) feasible with 2-ply webs.

(2) When the glue line on the core reaches 6 o'clock where the core presses the glue against the web creating transfer of the severed web to the core, the radial acceleration which the glue must overcome for successful transfer is very low compared with prior art winders.

(3) The core irons the glue line against the web 3 times before the first wrap around the core is completed. By contrast:

(a) On a prior art center-wind rewinder, the transfer pads iron the web against the glue only once.

(b) On a rewinder, according to the '877 patent, the core irons the glue against the web only twice.

(4) The glue line on the core covers the entire web width for best possible transfer action. By contrast, on prior art rewinders, the transfer glue is applied to the core as narrow rings which cover much less than 1/2 the web width.

(5) During the initial rotation of the core after web break-off until the glue line reaches 12 o'clock, the winder does not take away all the web being perforated. This creates a brief period of low web tension (virtually zero), which means that the transfer glue does not have to overcome any web tension and the first wrap around the core will be somewhat loose and wrinkled. This is a minor disadvantage compared to the result produced by the embodiment of FIGS. 1-10 but is completely justified in terms of the significant reduction in machine complexity. Thereafter the united web and core advance to the nip 223 defined by an intermediate point in the run of the upper belts 209 and the upstream end of the lower belts 210.

(6) The whole process is independent of core diameter. The modification of FIG. 11 also permits the opportunity to include a unique feature which has never been used before. A dancer roll can now be positioned between the perforator and winding to control winding tension directly.

Also, there are some variations of this new "double-belt" surface rewinder concept which may be useful in some applications:

(1) Eliminate the pinch-plate mechanism 221. The machine still makes logs reliably, but the logs contain quality defects which may be unacceptable.

(a) Sheets per log will vary ± 5 sheets - (approximately).

(b) Break-off may be on two or more different lines of perforation, leaving a ragged, uneven, tail on the log.

(c) Tail folded back around the core may be as long as 5 sheets.

(d) With 2-ply webs, the two plies may break at different lines of perforation.

(2) Eliminate the pinch-plate mechanism 221 and by means of a double flexing blade perforator which makes a very weak line of perforation, instead of the normal perforation, once per winding cycle. Then time core insertion in the transfer nip to occur shortly (2 to 3 inches) after the very weak perforation passes that nip.

(3) For non-perforated products, eliminate the pinch-plate mechanism 221 and make a line of perforation once per winding cycle. Then time core insertion in the transfer nip to occur shortly (2 to 3 inches) after the perforation passes that nip.

Features and Advantages of FIG. 11 Embodiment

(1) ALL motions and actions are continuous, steady, and rotary. There are no cams, cranks, indexers, or similar devices.

(2) Performance up to 60 LPM and above 3000 FPM.

Other modifications include the use of the hypocycloidal core feeder 218 in combination with a prior art surface winder 301 of the '877 patent type as seen in FIG. 18.

In the embodiment of FIG. 18 relative to the winder 301, winding is achieved by coaction of a three roll cluster including rolls 311, 314 and a rider roll 324. Cutoff is achieved through cooperation of the roll 311 and the stationary plate 317 much as in the operation previously described with reference to FIG. 14 where the core holds the web against the stationary plate at B and the product being wound creates a second holding point as at A.

The same operation is possible by a modified version as seen in FIG. 18A. There, the winding cradle rolls are the same as in FIG. 18 but a larger stationary plate 417 is provided –thereby eliminating the lower nip forming roll 206. Also possible is the use of a conventional core feeder 501 in conjunction with the inventive surface winder having belts 209, 310 as seen in FIG. 19. The feeder 501 has an articulated arm 502 which moves from a core pick-up station to an adhesive pick-up station to a nip station while under the control of a pivot arm 503.

While in the foregoing specification a detailed description of an embodiment of the invention has been set down for the purpose of illustration, many variations in the details hereingiven may be made by those skilled in the art without departing from the spirit and scope of the invention.

Claims

1. In a method of transporting cores from a source (22, 219) to a nip-defining winding station (15, 208) in a continuous winding machine for web logs wherein cores are sequentially removed from said source in synchronism with the winding of said web into successive logs characterized by moving said cores through a generally hypocycloidal path (28, 227) to rapdily introduce said cores into said nip.

2. The method of claim 1 in which said hypocycloidal path is character ized by a plurality of cusps (226a, 227a, 228a), removing cores from said source at one of said cusps and introducing said cores into said nip at a second of said cusps.

3. The method of claim 2 in which adhesive is applied to each core at a third of said cusps.

4. The method of claim 3 in which each core is moved sequentially through two 3 cusped hypocycloidal paths, the first of said paths having a cusp at which said adhesive is applied, the second of said paths having a cusp located at said nip.

5. A method according to claim 1 for operating a surface winder having a source of cores and a nip for receiving cores to be wound comprising sequentially moving cores from said source to said nip along a path characterized by a plurality of cusps, a first cusp being located adjacent said source, a second cusp being located adjacent adhesive applying means and a third cusp being located adjacent said nip.

6. The method of claim 5 in which a core transport member is provided for supporting said cores along said path, said member being orbited while a supported core is revolved therearound to provide said cusps, and selectively communicating vacuum to said member to engage a core at said source and to disengage a core at said nip.

7. A surface winder for the method of claim 1 comprising a frame, means on said frame for delivering a web to a winding station for winding on a core, and core transport means on said frame for delivering a core to said winding station, said core transport means including means on said frame for moving said core through a generally hypocycloidal path.

8. The structure of claim 7 in which said core transport means includes two mechanisms each operative to move a core through hypocycloidal paths, one of said mechanisms being operative to move a core past a glue applying station and the other mechanism being operative to deliver said core to said winding station.

9. The structure of claim 7 in which said transport means is equipped with vacuum puck means for gripping a core along the length thereof, and vacuum program means operably associated with said transport means for selectively applying and turning off vacuum so that a core may be picked up and discharged selectively.

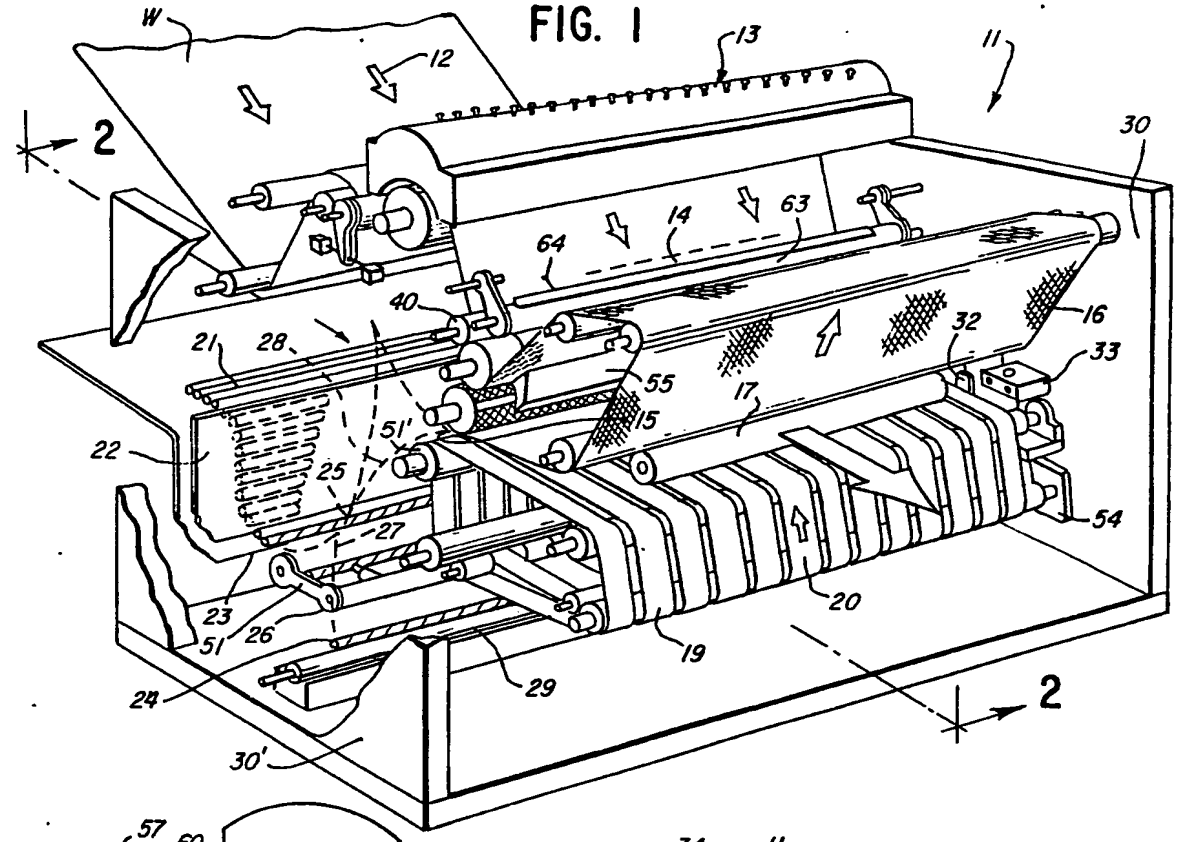
10. The structure of claim 7 in which said core transport means includes stationary shaft means fixed in said frame, arm means rotatably mounted on said shaft means and rotatably carrying core transport roll means in spaced parallel relation to said stationary shaft means, first pulley means operably associated with said frame for rotating said arm means and thereby orbiting said core transport roll means relative to said stationary shaft means,

second pulley means operably associated with said stationary shaft means for rotating said core transport roll means, puck means on said core transport roll means extending generally radially thereof for engaging a core and vacuum means interconnected between said frame arm means core transport roll means and puck means for selectively engaging and releasing cores sequentially.

11. A surface winder for the method of claim 1 comprising a frame means on said frame defining a nip for the receipt of a core to be wound with web material, a source of cores operably associated with said frame, and core transport means on said frame between said source and said nip for sequentially moving cores from said source to said nip, said core transport means including a core engaging member and means operably associated with said core engaging member for orbiting the same while simultaneously therewith revolving an engaged core about said member, and program means for selectively engaging and disengaging a core from said member.

12. The structure of claim 11 in which said orbiting means and said revolving means are arranged and organized to provide a core transport path characterized by a plurality of cusps, a first of said cusps being positioned adjacent adhesive applying means on said frame and a second of said cusps being positioned adjacent said nip.

FIG. 1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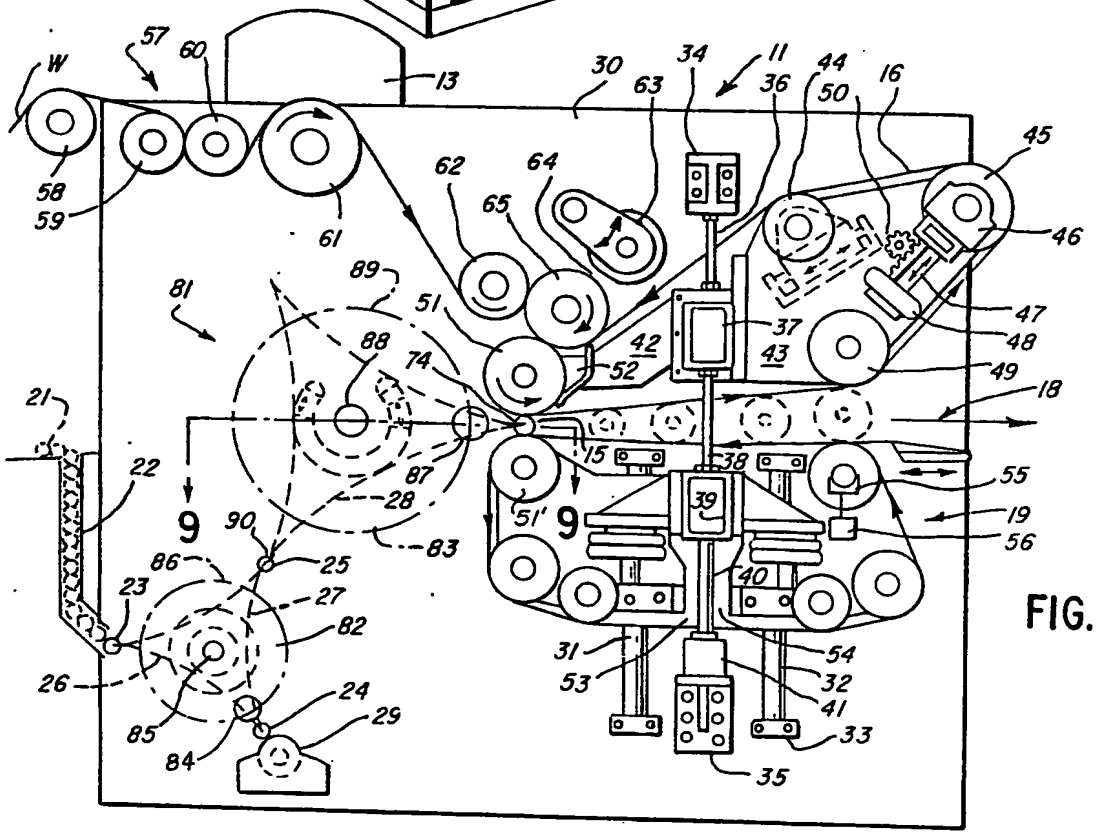
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FIG. 2

FIG. 3

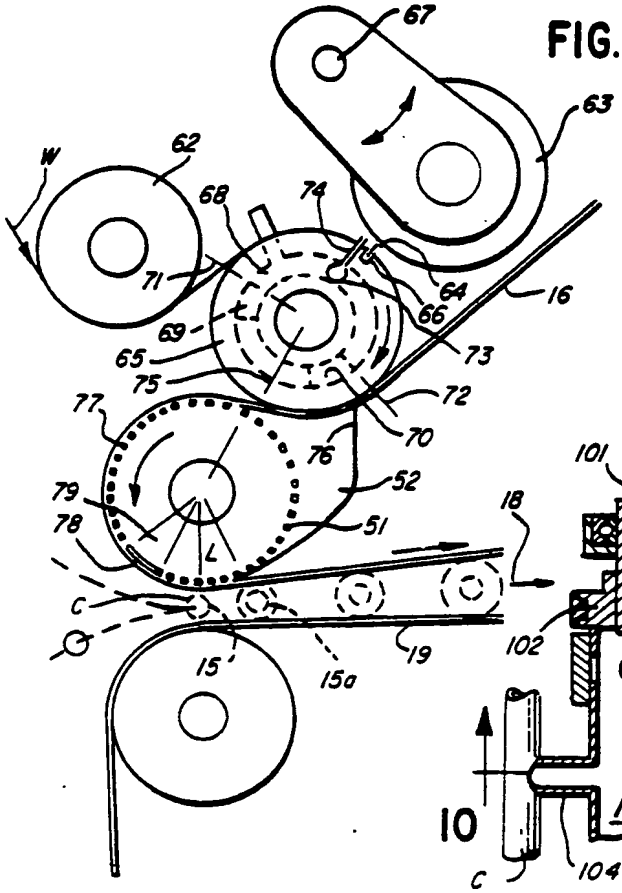
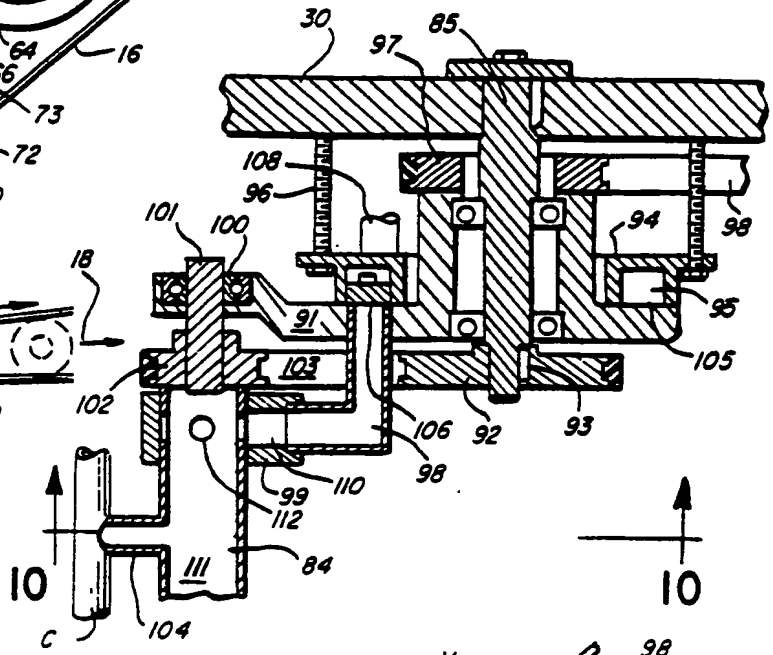


FIG. 9



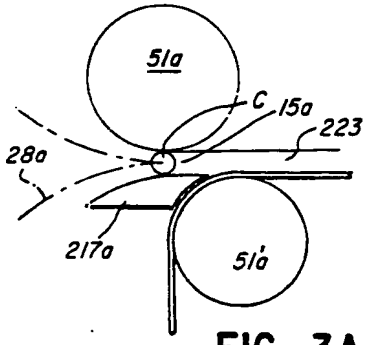


FIG. 3A

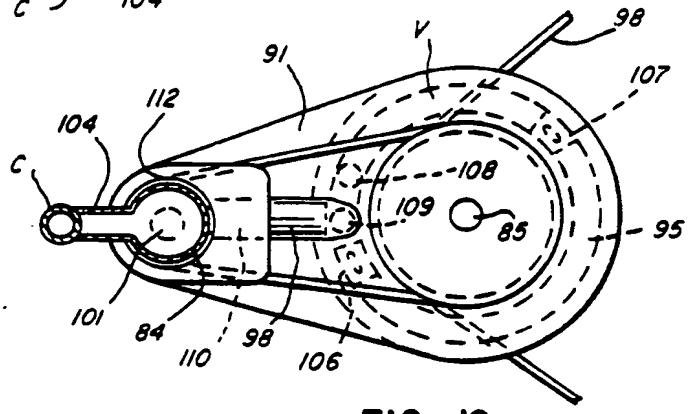


FIG. 10

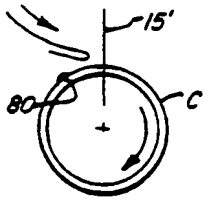


FIG. 4

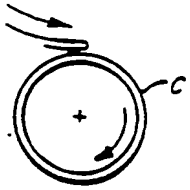


FIG. 5

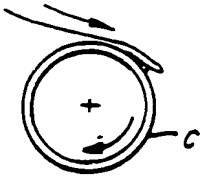


FIG. 6

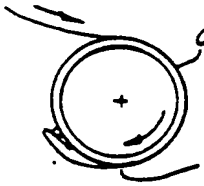


FIG. 7

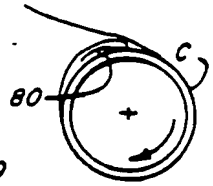


FIG. 8

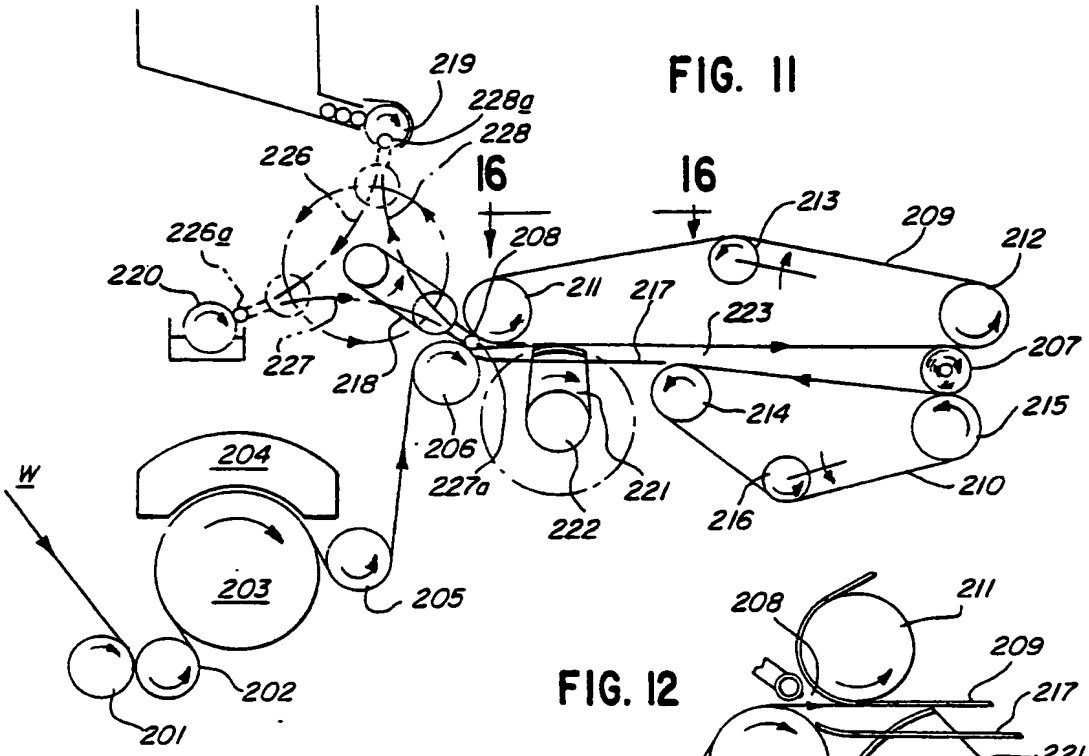


FIG. 11

FIG. 12

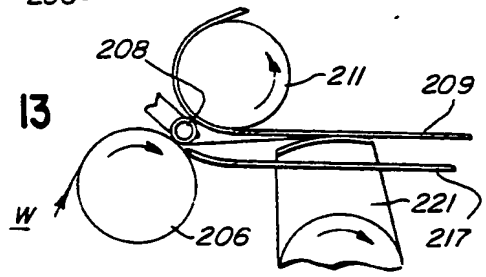


FIG. 13

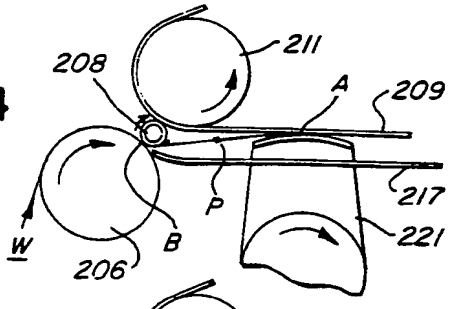


FIG. 14

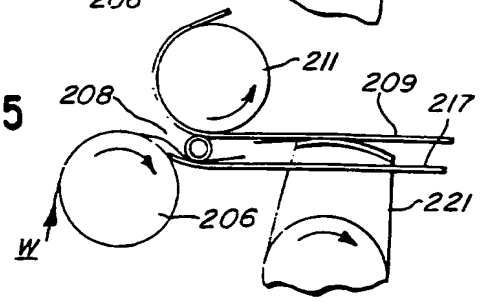


FIG. 15

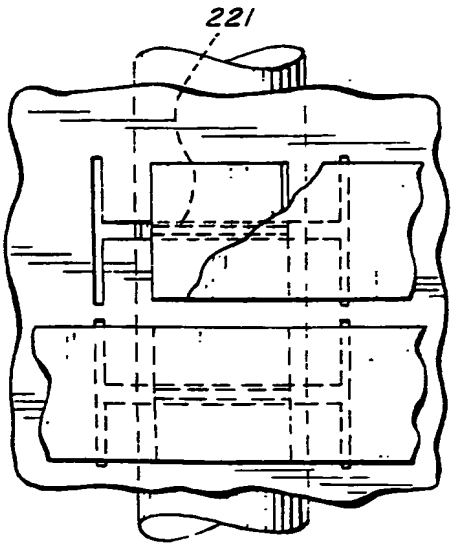
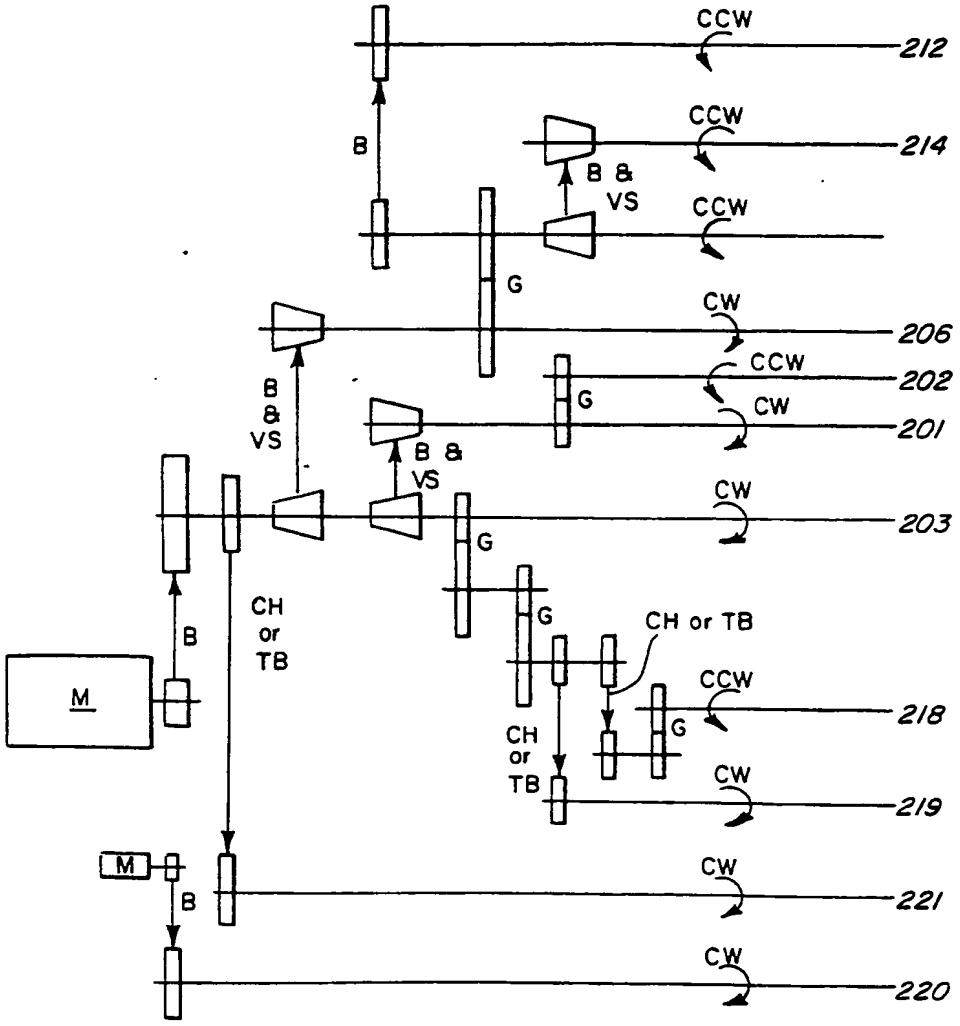


FIG. 16

FIG. 17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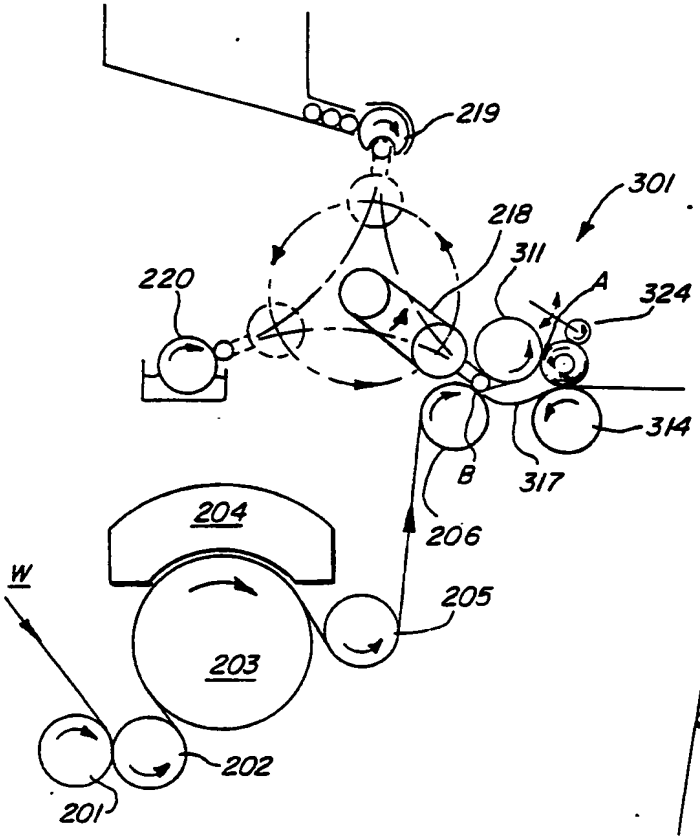

FIG. 18

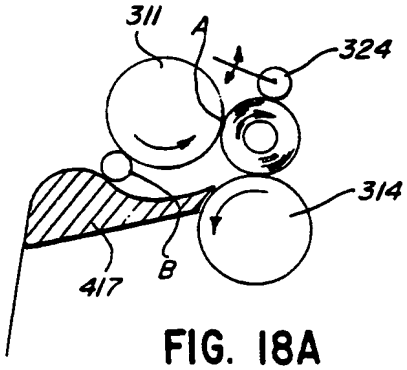

FIG. 18A

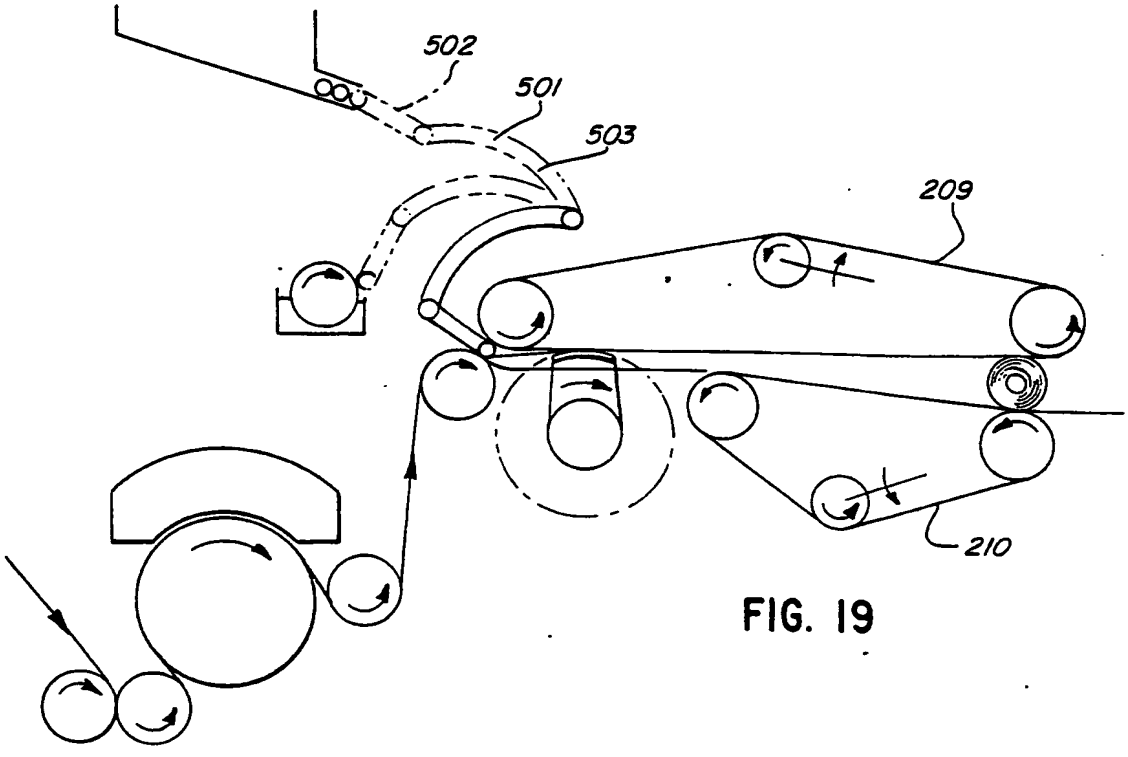

FIG. 19

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 219 555 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
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(54) Re-reeling device for forming a roll of paper in a re-reeling machine

(57) A re-reeling device for forming a roll of paper in a re-reeling machine comprising, on a frame, three rollers (16, 17, 18) having mutually parallel axes that are perpendicular to the direction of feed of the paper (11), in which two winding rollers, a bottom one (17) and a top one (16), supported on the frame, co-operate with a third roller (18) that maintains a certain pressure on a roll of paper or log being formed, where the third roller (18) is carried by a pair of arms (22) which can oscillate with respect to the frame, the paper (11) that is being wound passing on one of the two rollers, and the finished roll or log (19) coming out of an outlet aperture or gap (30) identified between the bottom roller and the third roller, the cores (12) for said rolls being fed, one after another, by a pusher (15) and being introduced into a calibrated channel (24) made underneath the top roller (16).

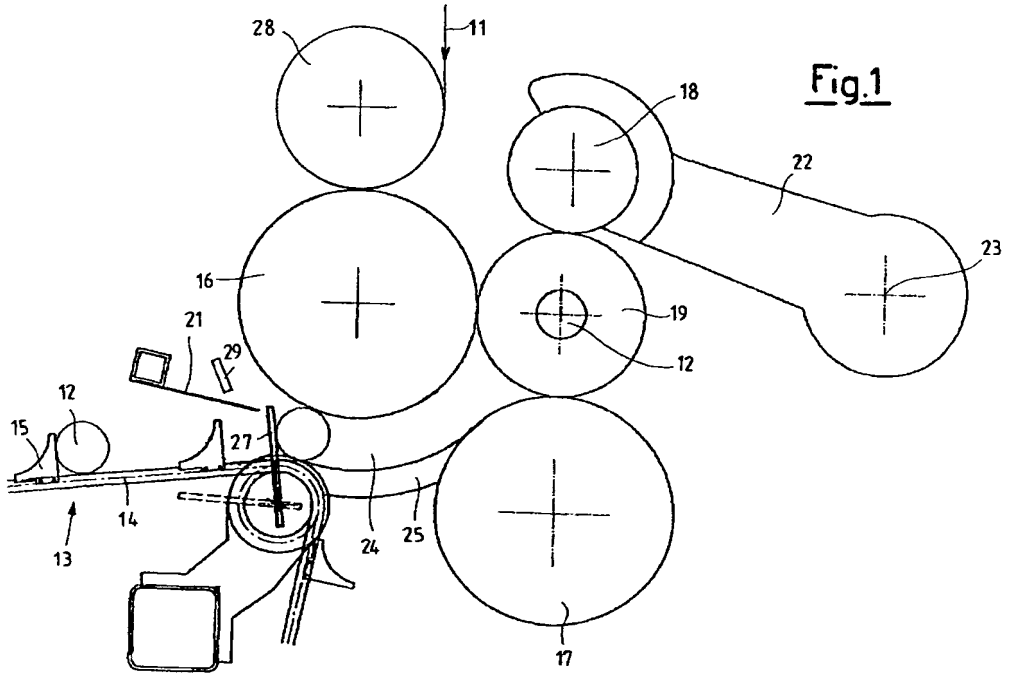


Fig.1

EP 1 219 555 A1

Description

[0001] The present invention relates to a re-reeling device for forming a roll of paper in a re-reeling machine.

[0002] It is known that in machines or assemblies for winding paper for domestic use, in particular paper subsequently to be used as toilet paper, wipes, serviettes, handkerchiefs and the like, there are provided elements that guide the incoming paper and control proper winding thereof onto a core to produce a finished roll referred to as "log".

[0003] It is likewise known that such machines, known as re-reeling machines, usually have two winding rollers and a third pressure roller. It is evident that the two former rollers bring about winding of the paper into a roll, which progressively grows in diameter, whilst the third roller, in addition to co-operating in this winding operation, maintains a certain pressure on the roll or log to make sure that it is wound in a compacted way.

[0004] In general, the two rollers have a position that is fixed with respect to the frame and support the log, drawing along the paper, whilst the third roller, acting as pressure roller, exerts pressure on the log being formed and hence determines the diameter of the finished product.

[0005] In order to do so, the third roller, or "pressure roller", is supported at opposite ends of at least one pair of arms that are pivoted to the frame. The third roller can thus oscillate according to a curved direction about the pivoting axis of the arms, and the pressure exerted thereon can be controlled by means of a sensor.

[0006] In general, there exist problems of feeding of the internal core of the roll into the machine, as well as problems of separation of the finished roll and positioning of the leading end of the incoming paper on the new core.

[0007] For example, in the Italian patent No. 1 262 046, a special arrangement is envisaged of a means for interrupting the ribbon-like material that co-operates with means for feeding along a channel, between a position of insertion of a new core and a groove or outlet gap for the core between the three rollers so as to enable the roll of paper to be wound.

[0008] The arrangement of this means for interrupting passage of the ribbon-like material involves a somewhat complicated synchronization between the parts and does not enable the re-reeling operation to be accelerated.

[0009] A purpose of the present invention is thus to provide a re-reeling device for forming a roll of paper in a re-reeling machine which will overcome the problems referred to above and which can operate in an optimal way even in the absence of the interruption means mentioned previously.

[0010] Another purpose of the present invention is to provide a device that will be able to overcome the operating problems of synchronization between the said interruption means and the acceleration of the pressure roller.

[0011] Yet a further purpose of the invention is that of providing a device which, whilst solving the problems referred to above, is at the same time able to reduce squeezing of the outgoing finished roll or log to a minimum.

[0012] These purposes according to the present invention are achieved by providing a re-reeling device for forming a roll of paper in a re-reeling machine as specified in Claim 1.

[0013] Further, more detailed, characteristics are presented in the subsequent claims.

[0014] The characteristics and advantages of a re-reeling device for forming a roll of paper in a re-reeling machine will emerge more clearly from the ensuing description provided by way of non-limiting example, with reference to the attached schematic drawings, in which:

- Figure 1 is a schematic side elevation view of the re-reeling device for forming a roll of paper in a re-reeling machine built according to the present invention; and
- Figure 2 is a side elevation view similar to that of Figure 1 in a subsequent operating step of the device.

[0015] With reference to the figures referred to above, there is shown a central part of a machine for winding paper 11, in particular paper to be used as toilet paper, wipes, serviettes, handkerchiefs and the like, in which there is set the re-reeling device for forming a roll of paper in a re-reeling machine according to the present invention. In general, the paper 11 that is fed in is paper made up of one or more combined ribbons, once the latter have been unrolled from respective rolls (not shown).

[0016] In particular, the paper in the form of a ribbon 11, which comes off a large roll (not shown), must be wound onto a central tubular core 12, the cores 12 being fed in one after another by means of a special pusher assembly 13.

[0017] In fact, the pusher assembly 13 comprises, for example, chains 14, which are parallel to one another (only one of these is shown in the figure) and on which pushers 15 are arranged, which are set at a distance apart from one another and pick up the cores from a magazine (not shown).

[0018] The said pusher assembly 13, which carries the tubular cores 12, is set facing an arrangement of three rollers 16, 17 and 18, which guide the incoming continuous ribbon of paper 11 and control it so that it winds properly onto the aforesaid core 12 to form a finished roll of a given size, commonly referred to as "log" and designated by 19.

[0019] It can be immediately noted from the figure that the three rollers 16, 17, and 18 have mutually parallel axes, which are perpendicular to the direction of feed of the paper 11. Of the aforesaid three rollers two are for

winding, a bottom one 17 and a top one 16, and these both co-operate with the third roller 18.

[0020] The rollers 16 and 17, which rotate fixed with respect to a frame of the machine, form between them an intake aperture or gap 20. This intake gap 20 is used for receiving the aforesaid core 12, which is carried by the pusher assembly 13, and, in order to block the core 12 in this position, there is provided a compliant blocking element 21. In addition, it is also possible to provide a dispenser element 29 for dispensing adhesive.

[0021] The third roller 18, which, as has been said, co-operates with the two rollers 16 and 17 for winding the paper 11, also maintains a certain pressure on the roll or log being formed, to ensure proper winding of the paper. The said roller 18, known as "pressure roller", is supported at opposite ends of at least one pair of arms 22 (only one of these arms being represented in the figure), which are pivoted in 23 to the frame. The third roller 18 is thus able to oscillate about the pivoting axis 23 of the arms and undergoes a control of the pressure that acts thereon by means of a sensor or similar element (not shown).

[0022] Furthermore, an outlet aperture or gap 30 is identified, provided between the bottom roller 17 and the third roller, or pressure roller, 18.

[0023] According to the present invention, the cores 12, which pass through the intake gap 20, identified between the top roller 16 and the bottom roller 17, are inserted into a calibrated channel 24 that is defined by curved elements 25, set side by side (only one of these being illustrated in the figure), designed to be inserted at least partially, by means of their ends, within channels or grooves 26 made in the bottom roller 17. The bottom roller 17 may in any case also be smooth, and the said curved elements in this case rest on the surface thereof.

[0024] As has been said, the channel 24 is calibrated, it being similar in size to the outer diameter of the core 12.

[0025] In addition, a second pusher 27 is provided, of a rotating or oscillating type, which co-operates in inserting the core 12, possibly provided with adhesive, within the channel 24.

[0026] The interference between the core 12 and the paper 11 wound on the top roller 16 above the channel 24 enables the paper, once the pressure roller 18 has accelerated and torn the trailing end of a finished roll 19, to bring about winding of the leading end of the paper 11 directly. This means that as soon as the acceleration of the pressure roller 18 has torn the trailing end of a finished roll 19, a new core 12 is inserted into the calibrated channel 24. This new core 12, which may possibly be, but is not necessarily, provided with a line of adhesive on a generatrix of its surface, is inserted into the calibrated channel 24, as a result of its sliding on the curved elements 25 and also as a result of the action of the second rotating or oscillating pusher 27.

[0027] Figure 1 shows a first step in which the three rollers 16, 17 and 18 support an almost finished roll, whilst at the intake gap 20 there is set a new core 12 that is ready to be introduced, also with the possible aid of the second oscillating pusher 27, which brings about yielding of the compliant blocking element 21, thus releasing the core 12.

[0028] Acceleration of the pressure roller 18 brings about acceleration and tearing of the trailing end of the finished roll 19. Then the new core 12 enters the channel 24, the said core being supported by the curved elements 25.

[0029] The calibrated dimensions of the channel 24 enable rotation of the core 12 and adhesion of the leading end of the paper 11, when this reaches the top roller 16, on the core itself, the said adhesion possibly being improved also thanks to the adhesive.

[0030] There may possibly be provided another deviator roller 28, located above the top roller 16, which keeps the paper 11 stretched so that it cannot return backwards when it is torn by the pressure roller 18.

[0031] Figure 2 shows a different step of operation of the device, in which the finished roll or log 19 has been ejected from the outlet gap 30 provided between the bottom roller 17 and the third roller, or pressure roller, 18.

[0032] In the figure, the core 12 has moved almost to the end of the channel 24, with the leading end of the paper 11 wound on it, and is ready to pass between the three rollers 16, 17 and 18 so that winding of a new roll can be carried out. Furthermore, a new core 12 has already been brought by a pusher 15 up to the intake gap 20, ready to be inserted into the channel.

[0033] The foregoing makes it possible to eliminate the means of interruption of the ribbon-like material envisaged in the prior art, so simplifying the device considerably.

[0034] The particular structure of the device of the present invention, when incorporated into a machine designed for making rolls of paper, as has been said previously, makes it possible to have maximum functionality with minimum presence of working parts, thus accelerating the introduction of the cores up to a number that is twice the number currently introduced, and hence an important increase in the production of logs per unit time can be achieved.

[0035] It is evident that the example of embodiment illustrated is only one of the possible embodiments. It may be understood that further examples of embodiments may be devised, all falling within the same innovative idea of the present invention.

Claims

1. A re-reeling device for forming a roll of paper in a re-reeling machine comprising, on a frame, three rollers (16, 17, 18) having mutually parallel axes that are perpendicular to the direction of feed of the paper (11), in which two winding rollers, a bottom one (17) and a top one (16), supported on the frame,

co-operate with a third roller (18) that maintains a certain pressure on a roll of paper or log being formed, where the third roller (18) is carried by a pair of arms (22) which can oscillate with respect to the frame, the paper (11) that is being wound passing on one (16) of the two rollers, and the finished roll or log (19) coming out of an outlet aperture or gap identified between the bottom roller (17) and the third roller (18), the cores (12) for said rolls being fed, one after another, by a pusher assembly (13), **characterized in that** said cores (12) are introduced into a calibrated channel (24) made underneath the top roller (16).

2. The device according to Claim 1, **characterized in that** said calibrated channel (24) is identified by curved elements (25) arranged underneath said top roller (16).

3. The device according to Claim 2, **characterized in that** said curved elements (25) are set alongside one another and are designed to be inserted, at least partially by means of their ends, within grooves (26) made in said bottom roller (17).

4. The device according to Claim 1, **characterized in that**, in an area corresponding to an intake gap (20) in said channel (24), there is provided a pusher (27) that co-operates to insert one core after another (12) into said channel (24).

5. The device according to Claim 4, **characterized in that** said pusher (27) is of the rotating or oscillating type.

6. The device according to Claim 1, **characterized in that**, in an area corresponding to an intake gap (20) in said channel (24), there is provided a dispensing element for dispensing adhesive (29).

7. The device according to Claim 1, **characterized in that**, above said top roller (16), there is located a further deviating roller (28) that maintains the paper (11) stretched, so preventing it from returning backwards.

8. The device according to Claim 1, **characterized in that**, in an area corresponding to an intake gap (20) in said channel (24), there is provided a compliant blocking element (21) acting on a core (12) carried by a pusher (15) of said pusher assembly (13).

Fig.1

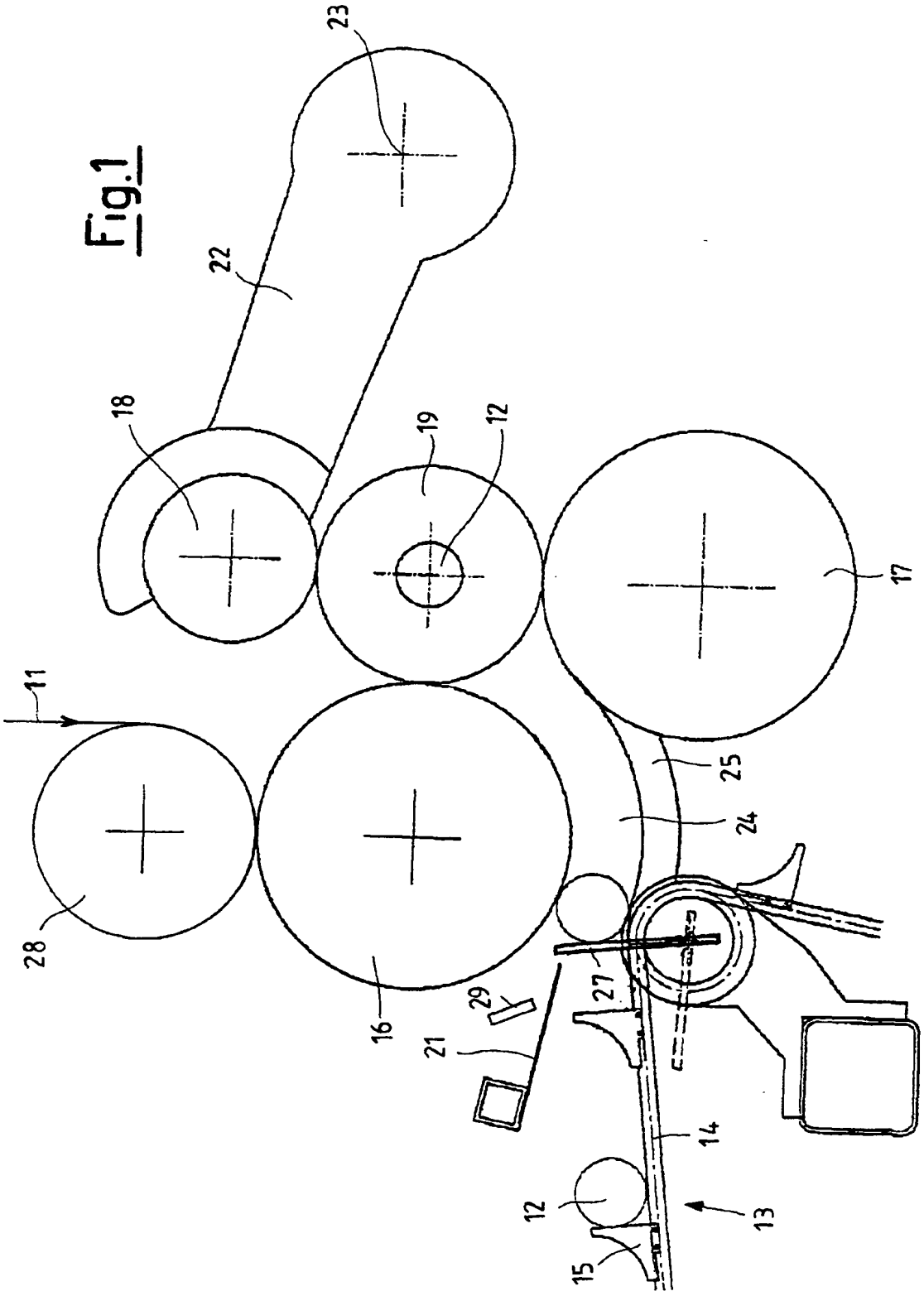
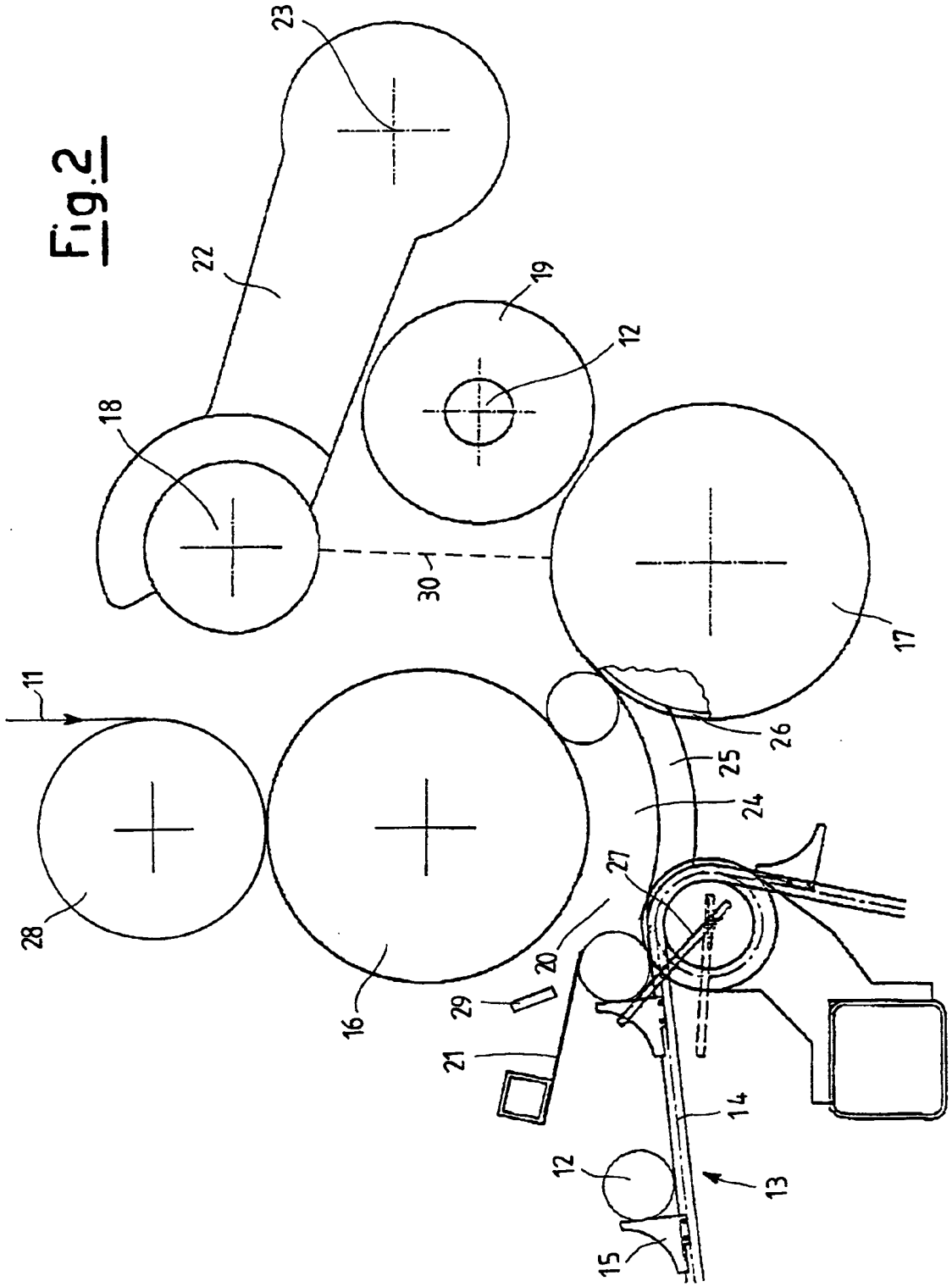


Fig.2



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 20 5021

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B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	5 March 2002	Uhlig, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

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9372 9 March 1973 in
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(52) Index at acceptance
B8R 8A2 8A4

(54) WINDING DEVICE FOR PAPER WEBS OR THE LIKE

(71) I, FABIO PERINI, an Italian citizen of Palazzo Giusti, S. Marco, Lucca, Italy, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is directed to a device for continuous winding of strips or webs of paper, such as toilet paper or the like into rolls. The device is also designed to allow the use of tubular cores of cardboard or the like, without the presence of a reinforcement mandrel. Additional advantages and requirements will result from the following specification.

According to the invention, there is provided a device for continuous winding of a paper web into rolls, such as toilet paper or the like, including a first cylinder adapted to be driven at a peripheral speed equal to the feed speed of the web to be wound; a second cylinder spaced from the first cylinder by an amount corresponding to the diameter of the winding cores onto which the webs are to be wound, said second cylinder being adapted to be driven at a peripheral speed equal to that of the first cylinder during winding of the webs into rolls, and at a lower speed during the core replacement stage; means to insert a core between said two cylinders, a roller adapted to rotate in contact with the roll being wound so as to retain the same in contact with the first and second cylinders, and means for driving the said roller during the separation stage of the completed roll at a peripheral speed different from the feed speed to cause the completed roll to roll on one of the cylinders and separate from the other.

Said roller may be carried by oscillating arms in such a manner as to be moved with the progressive increase of the diameter of the roll being formed, and may fall back into an initial stopping position after the separation of the completed roll.

According to one form of the invention, said roller is driven with a peripheral speed equal to that of the material feed during the winding stage is slowed down or braked shortly during the separation stage of a completed roll and of introduction of a new core.

According to a further embodiment the movable roller or pressing unit is accelerated during the separation stage and blowing means are provided at least between one of the cylinders and said roller.

The invention will be further described with reference to the accompanying drawings, which show embodiments of the invention, which are given by way of example only and not by way of limitation.

In the drawings:

Fig. 1 illustrates an overall diagrammatic view of a first form of the machine;

Fig. 2, 3, 4, 5, 6 and 7 illustrate in detail the main operative members of the machine alone and under the conditions corresponding to the several stages of replacement of a wound of roll by a core ready to continue the winding of the material fed thereto;

Figs. 8 and 9 illustrate respectively a detail in a view taken along the line VIII—VIII of Fig. 1 and in an enlarged section taken along the line IX—IX of Fig. 8;

Fig. 10 illustrates an overall view of a modified form of machine in a vertical section taken along a plane perpendicular to the axis of the cylinders and cores;

Figs. 11 and 12 illustrate details of Fig. 10 in two different stages of the winding of a reel onto a tubular core and of replacement of a tubular core.

According to Figs. 1 to 9 of the accompanying drawing, 1 denotes a cylinder which is designed to feed the material to a roll or reel being wound. The material arrives according to the arrow *f*1 of Fig. 1 and its course is denoted by the line M. Said material passes between a pair of feed rolls 3 which are in particular embossing cylinders, and is forwarded over rollers 5, 7 and 9, the latter being a tensioning roller. At least the roller 9 may be rotationally driven at the feed speed set by the peripheral speeds of the rolls 3 and of the cylinder 1. The cylinder 1 has a plurality of deep annular grooves 1A (also see Fig. 8) into which toothed belts 11 and respective supporting

arms 13 extend, said arms 13 being carried by a structure 15 (also see Fig. 9). Said belts 11 form a conveyor.

A main drive shaft 17 drives by belts or chains shown dotted in Fig. 1 the embossing feed rolls 3, the rollers 7 and 9 the cylinder 1 and through the latter the toothed belts 11. All these components are driven to obtain a peripheral speed corresponding to the speed of the fed material, except that the speed of the belts 11 is lower. The belts 11 project slightly from the surface of the cylinder 1, as indicated in Fig. 9.

Reference numeral 19 indicates a drive from the shaft 17 to a speed reducer unit 21, including a suitable clutch arrangement so as to drive a drive belt 23 selectively at two speeds differing somewhat from each other, for instance by about 3% or 4%. The drive belt 23, is in driving engagement with a second cylinder 25 to drive the same in its higher speed mode at a running speed corresponding to the peripheral speed of the cylinder 1 and to feed speed of the paper web material, which at the lower speed of the belt 23, the cylinder 25 assumes a lower peripheral speed, for instance, approximately 3—4% lower than the peripheral speed of the cylinder 1. Such fine adjustment of the peripheral speed of the cylinder 25 (with respect to that of the cylinder 1) serves to adjust the tightness of the winding of the reels.

27 denotes a drive from the drive shaft 17 to a braking unit 29, which may alternatively drive a second flexible drive 31 or may determine a short stopping period or at least a deceleration period of said drive 31. 33 denotes an arm movable and stressed through a cylinder-piston system 35, said arm 33 being movable about a shaft 37 and said arm carrying at the movable end a roller 39 having its axis parallel to those of the cylinders 25 and 1. The drive 31 drives a transmission shaft coaxial with the shaft 37 of the arm 33; this transmission shaft, through a drive 41, drives the roller 39 in rotation. The drives 27, 31, and 41 are such that the roller 39 is driven with a peripheral speed corresponding to that of the cylinders 1 and 25 unless the brake 29 is applied.

43 denotes a reservoir chute for the tubular cores to be fed to the winding machine and, in particular, to be fed between the two cylinders 1 and 25, the cores being in general of cardboard or the like and an internal reinforcement mandrel is not required. Said cores are denoted by B and they are retained as a column in the reservoir chute 43 by means of a device which allows the delivery thereof one at a time as it is possible to see particularly by comparing Figs. 5 and 6. In particular, said device includes a cylinder-piston control system 45 which acts on two pairs of retaining teeth 47 and 49 to insert and withdraw them from the reservoir chute in a predetermined sequence. The retaining teeth 47, under the normal winding conditions, retain the column of cores B by holding the lowermost core BO while the teeth 49 are retracted as in Figs. 3, 4 and 5. When the core BO is to be fed, control 45 actuates the retaining teeth 49 into the position projecting in the reservoir chute 43, so as to retain the core B_2 (Figs. 5 and 6). The retaining teeth 47 are then withdrawn to release the core BO (Fig. 6) towards the portion B1 of Fig. 4.

The reservoir chute 43 is formed with lower lateral retaining saddles 43A having forward extensions 43B substantially tangential to but stopping short of the cylinder 1. Parallel with extensions 43B, there are also guides 51 for a carriage 53 adapted to thrust cores from the position B1 into engagement into the cylinders 1 and 25. The core falls down the reservoir chute 43 and the position B1, where it is retained by the saddles 43A and extensions 43B. The carriage 53 (see especially Figs. 2 to 7) has a thrust surface 53A making an acute angle with the extensions 43B. The carriage 53 has a reciprocal motion in the guides 51, being actuated by a crank 55 linked to an eccentric of a disc 57, which itself is driven by the shaft 17 during the insertion cycle.

As an additional functional member of the machine, a guide surface 59 is provided arranged above the active upper run of the belts 11 and spaced therefrom by an amount of slightly less than the unstressed diameter of the fully wound reel which is to be moved away. Such surface 59 may be fixed in position and/or elastically urged towards the belts 11.

The machine also includes other per se known members which do not form part of the present invention. Among these, there are blade cylinders 61 and 63 designed to effect a perforation across the entire width of the advancing web at a fixed horizontal spacing.

The operation of the machine is the following.

The cores B are selectively delivered from the reservoir chute 43 by action of the retaining members 47 and 49, and the carriage 53 is advanced from the position of Figs. 2 to 4 into the position of Fig. 5, wherein it shifts the core from the position indicated by B1 to the position B7 between the cylinder 1 and the cylinder 25 with a slight forcing. The carriage thrust surface 53A active wall is inclined with respect to the plane containing the axes of the cylinders 1 and 25 and faces towards the cylinder 1, so that it tends to press the core B7 towards the cylinder 1. From the instant when the core B (Figs. 3 and 4) has been brought by the carriage 53 into the position

B6 shown in Fig. 5, subsequent movements are all effected by the cylinders 1 and 25 and by the roller 39. Under the conditions of Fig. 5 the cylinder 25 rotates with a peripheral speed slightly lower than the peripheral speed of the cylinder 1, and thus the core B tends to roll on the cylinder 25, going from the position B6 of Fig. 5 into the position B_3 of Fig. 6. In this position B_3, the core winds the material the winding being initiated pneumatically as will be described hereafter. When the forming reel is separated in a manner to be described hereafter, the core in the position B_3 begins the winding, moving into the position B_4 shown in Fig. 3, wherein the material wound on it contacts the cylinders 1 and 25 and the roller 39. The roller 39 is lowered onto the reel along a circular path T_{39} centred on the axis of the shaft 37, that is on the axis of the arm 33 carrying the roller 39. Under these conditions (Figs. 3 and 4) the members 1, 25 and 39 rotate with substantially equal peripheral speeds until the increasing diameter reel is fully formed, this determining a gradual movement of the reel from the position B_3 of Fig. 6 to the position B_4 of Fig. 3 and to the position B_5 of Fig. 4 and of Fig. 5, with a corresponding movement of the roller 39. At this point, the winding of the material on the reel being completed, the changes of relative speed of the members 25 and 39 take place and in this way the replacement of the core and the moving away of the formed reel or stick take place. In particular, under the conditions of Fig. 5, there occurs a small but significant reduction of peripheral speed (3—4%) of the cylinder 25 with respect to the cylinder 1, to obtain the advance of the new core from the position B7 into the position $B_{4'}$; simultaneously under the conditions of Fig. 5 a short stopping or at least a slowdown occurs owing to the braking of the roller 39, which determines a rolling round the roller 39 of the reel formed on the core around the roller 39, and thus the reel moves onto the conveyor represented by the belts 11, the reel being then spaced from the cylinder 25: the reel thus reaches the position denoted by B_6 in Figs. 6 and 7 to then reach subsequent positions such as that B_5 (Fig. 3) with a rolling along the guide surfaces 59 by action of the belts 11. Under the conditions shown in Figs. 6 and 7, the reel in the position B_6 has reduced its own peripheral speed of rotation owing to the lower speed of the belts 11 with which it is in contact. While the core in the position B_3 assumes the advancing or feed speed of the material, and thus the tangential speed corresponding to that of the cylinder 1. At this point, i.e. under the conditions of Fig. 6, an assembly of air nozzles 70 come into play. The nozzles are arranged for instance within the grooves 1A of the cylinder 1 with an orientation towards the cylinder 25 and thus towards the inter-space between the core position B_3 and the reel in position B_6 as shown in the array of Fig. 6. Air blown through the nozzles 70 forms loop M_2 in the material (Fig. 6) between the core position B_3 and the completed reel in the position B_6, owing to the reduced peripheral speed of this latter (in this stage) with respect to the speed of the fed material, the loop M_2 is eventually caught between the core in the position B_3 and the cylinder 25, which leads to the tearing of the paper web material at some point between the contact zone between the core in position B_3 and the cylinder 25 and the reel in position B_6. In practice, the tearing may take place at the position of perforations in the web. The material thus begins the winding on the core at position B_3, and proceeds continuously through the stages of the partial reel at position B_4, the position B_5, to the separation of the complete reel at position B_6 whence it proceeds to the position B_5 in Fig. 3. The roller 39 is lowered onto each successive reel being formed at the position B_4. The material is continuously fed while the winding goes through these various stages.

Figures 10 and 12 show an apparatus largely similar to that of Figs. 1 to 9 but having a different layout. The material to be wound follows a path M_x in a direction indicated by an arrow f_{12} round a cylinder 71 rotating in the direction of the arrow f_{16} with its peripheral speed equal to the feed speed of the material. A cylinder 73 located below and spaced from the cylinder 71 is adapted to be driven in the direction of arrow f_{14} either at the peripheral speed of cylinder 71 or at a speed slightly reduced with respect to that speed. The drive for this is disclosed in some detail with reference to cylinder 25 of Figs. 1 and 9.

A reservoir chute for cores B is shown at 79 and is associated with retaining members 81 and 83 and a feed carriage 85 with a thrust surface 85A operating in similar manner to the corresponding parts described with reference to Figs. 1 to 9 to feed the cores B seriatim from the chute 79 to a position between the cylinders 71 and 73 and indicated at B10 in Fig. 11.

In order to allow the positioning of the core at the position B_{10} (in alignment with the axes of the cylinders 71 and 73) the cylinder 73 is run for a short period at a lower speed whereby the core rolls in the direction of the arrow f_{16} around the cylinder 73, driven by the cylinder 71.

A roller or pressing unit 97 rotatable in the direction of an f_{18} has a two speed drive similar to the drive to the roller 39 of Figs. 1 to 9. The lower of the two peripheral speeds of the roller 97 corresponding to the

peripheral speed of the roller 31 at the feed speed of the material being fed. The higher peripheral speed is 3% to 4% above this speed.

Between the roller 97 and the cylinder 71 there is located a set of nozzles 103, arranged on a line parallel with the axes of the cylinder 71 and the roller 97, to blow towards the cylinder 73. A second set of nozzles 105 is arranged adjacent the cylinder 73 so as to direct a blowing towards the tubular core located in the position B_{10} and towards the cylinder 71. Owing to the arrangement of the cylinders as described and the trend of the material which arrives from above on the path M_x, the sets of nozzles 103 and 105 may be replaced by slit-like continuous nozzles so as to act on the material substantially uniformly in the transverse direction.

The operation of the winding device now described is the following: during the winding of the material on the core in the position B_{12} (see Fig. 12) the reel being formed is in contact with the cylinder 71, the cylinder 73 and the roller 97, and the roller or pressing unit 97 tends to rise gradually as the reel being formed increases its diameter. When the reel has reached a desired diameter or when a desired length of the material has been wound, the reel then being in the position indicated by B_{14} in Fig. 10, the replacement of the reel takes place. For this purpose the cylinder 73 reverts to its lower speed while the thrust carriage 85 carries a new tubular core towards the position B_{10}. Simultaneously, the roller 97 is temporarily accelerated to the higher speed to bring about an advance of the completed reel from the position B_{14} of Fig. 10 to the position B_{16} of Fig. 11 and subsequent motion in the direction of the arrow f20 by rolling of said reel B_{16} first on the cylinder 73 and subsequently on supporting surface 107 which starts up substantially tangential to the cylinder 73. The temporary reduction of speed of the cylinder 73 for the insertion of the new tubular core assists the separation of the complete reel B_{16} in the direction of the arrow *f20*, owing to the increased difference of peripheral speed between the accelerated roller 97 and the slowed down cylinder 73. The separation of the completed reel B_{16} leads to tearing of the material strip between the contact zone of the cylinder 71 with the newly inserted reel at position B_{10}, and the contact zone between the roller 97 and the reel B_{16} being separated. Within this length there is normally a single transverse perforation line. The blowing of the nozzle 103 facilitates this breakdown and this blowing also aids the insertion of the end M_1 of the material between the tubular core in the position B_{10} and the cylinder 73, as indicated in Fig. 11.

Subsequently, when said end M_1, winding up on the core has passed the contact line between the cylinder 73 and the reel, the blast of the nozzle 105 acts on said end (indicated now with a dotted line and with the reference M_2) in order to facilitate the insertion of said end M_2 between the core and the materal adhering to the roller 71. Therefore, the two blasts of the nozzles 103 and 105 facilitate the breakdown and the winding of the end of the material on the newly inserted core.

If the acceleration of the roller 97 and the simultaneous slowing down of the cylinder 73 do not cause the tearing and thus the separation of the material web from the reel now formed, then gradually the thrust of the blast generated by the nozzle 103 determines the forming of a loop of material which is inserted between the core and the cylinder 73; the seizing of the loop by the cylinder 73, which entrains it in the direction of the arrow f_{14}, leads to tearing of the material strip.

After the removal of the completed reel, the roller 97 is lowered again and is arranged to contact the newly inserted tubular core onto which the material has been wound and which moves from the position B_{10} to the position B_{12} to continue with the winding of the material.

The arrangement of Figs. 10 and 12 simplifies the provision of the nozzles 103 and 105 (with a continuous slit or not) and the passage of the material through the device is simpler than in the embodiment of Figs. 1 to 9. Also, the cylinders 71 and 73 are both provided with a uniform cylindrical surface, without any annular grooves, this being advantageous for the uniformity and regularity of the forming of the reels.

WHAT I CLAIM IS:—

1. A device for continuous winding of a paper web into rolls, such as toilet paper or the like, including a first cylinder adapted to be driven at a peripheral speed equal to the feed speed of the web to be wound; a second cylinder spaced from the first cylinder by an amount corresponding to the diameter of the winding cores onto which the webs can be wound, said second cylinder being adapted to be driven at a peripheral speed equal to that of the first cylinder during winding of the webs into rolls, and at a lower speed during the core replacement stage; means to insert a core between said two cylinders, a roller adapted to rotate in contact with the roll being wound so as to retain the same in contact with the first and second cylinder and means for driving the said roller during the separation stage of the completed roll at a peripheral speed different from the feed speed to cause the com-

pleted roll to roll on one of the cylinders and separate from the other.

2. A device as claimed in Claim 1, characterized in that said roller is slowed down or stopped during the separation stage.

3. A device as claimed in claims 1 and 2, characterized in that the first cylinder is provided with annular grooves accommodating belt conveyors for the completed roll; said conveyors being arranged to pick up the completed roll from the first cylinder after it has been separated from the second cylinder by the slowing of the roller.

4. A device as claimed in claim 3, in which a guide surface is arranged parallel to and spaced from said conveyors, which operate at a speed reduced with respect to feed speed.

5. A device as claimed in Claims 3 or 4, characterized in that, in combination with the conveyors, pneumatic nozzles are provided to act on a loop formed between the completed roll and the new core inserted between the first and second cylinders to initiate winding of the loop on said new core and also the tearing of the material.

6. A device as claimed in Claim 5, in which the nozzles are accommodated in the groove of the first cylinder.

7. A device as claimed in any of Claims 1 to 6, characterized in that the means to insert a core include a thrust means having a thrust surface inclined so as to stress the core towards the first cylinder.

8. A device as claimed in Claim 1, characterized in that the roller is accelerated during the separation stage, and that blowing means are provided at least between one of the cylinders and the roller.

9. A device as claimed in Claim 8, characterized in that the first cylinder overlies the second cylinder and is spaced therefrom by an amount corresponding to the diameter of a tubular core.

10. A device as claimed in Claim 8, characterized in that an assembly of nozzles is provided between the first cylinder and the movable roller to blow downwards and urge an end of the web between the tubular core just inserted and the second cylinder to begin the winding.

11. A device as claimed in Claim 10, characterized in that a further assembly of nozzles is provided to act between the first cylinder and the newly inserted tubular core, to aid the initial winding thereon.

12. A device as claimed in any of Claims 8 to 11, characterized in that a rolling surface is provided adjacent the zone of the second cylinder and the movable roller.

13. A device for continuous winding of a paper web into rolls substantially as above described and as illustrated in the accompanying drawings.

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1435525 COMPLETE SPECIFICATION
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Sheet 1

Fig.1

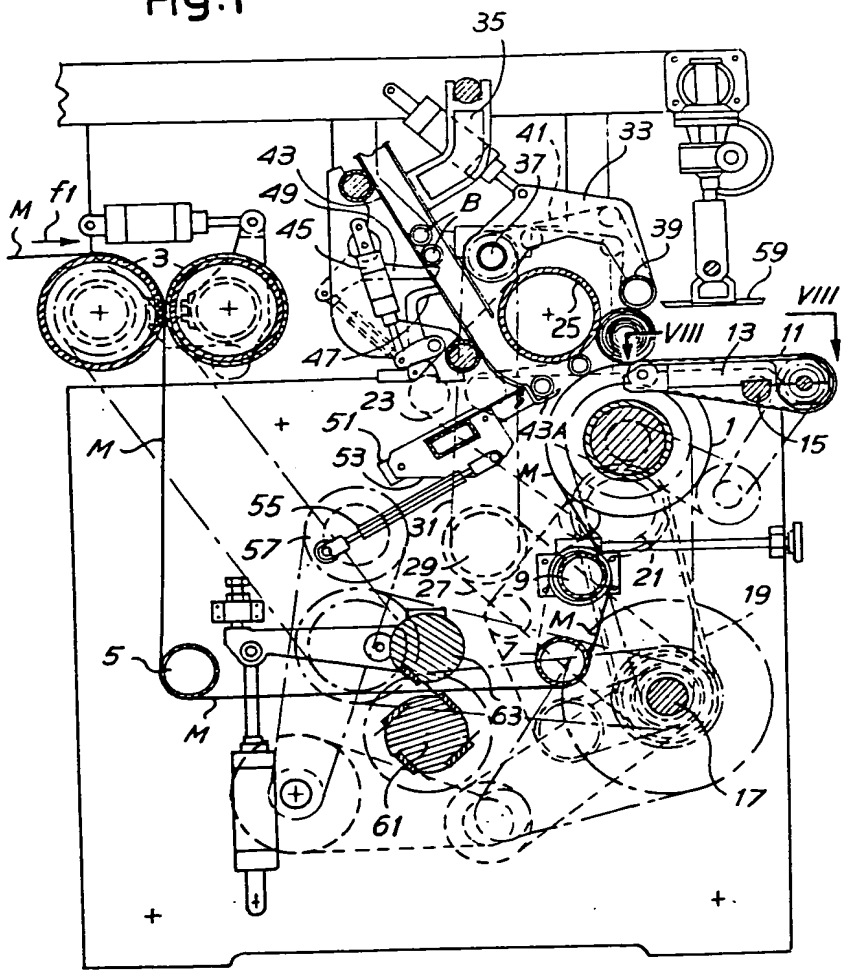

Fig.2

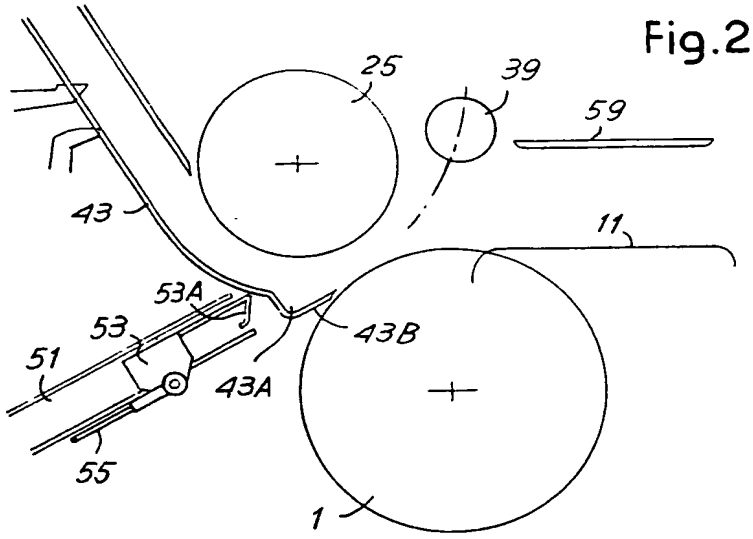
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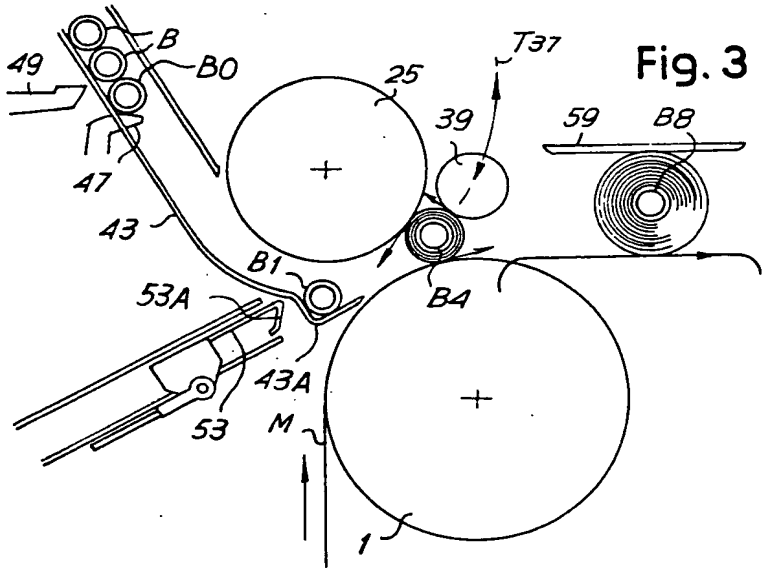
Fig. 3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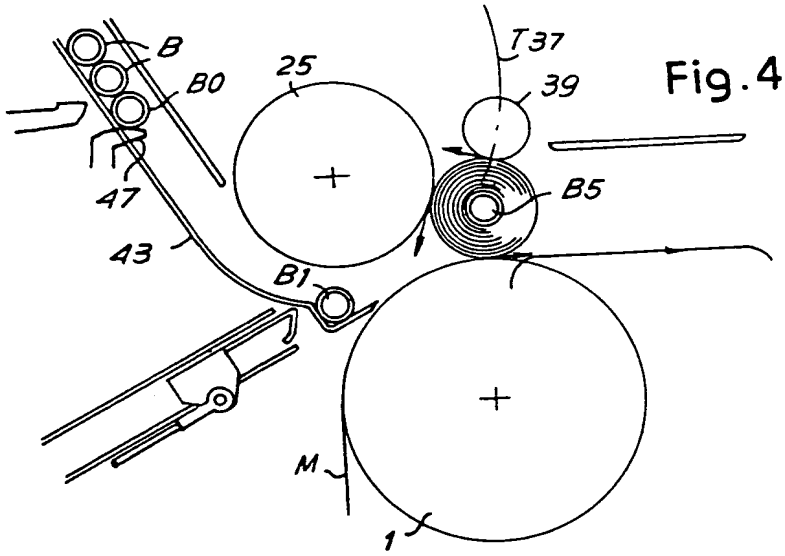

Fig.4

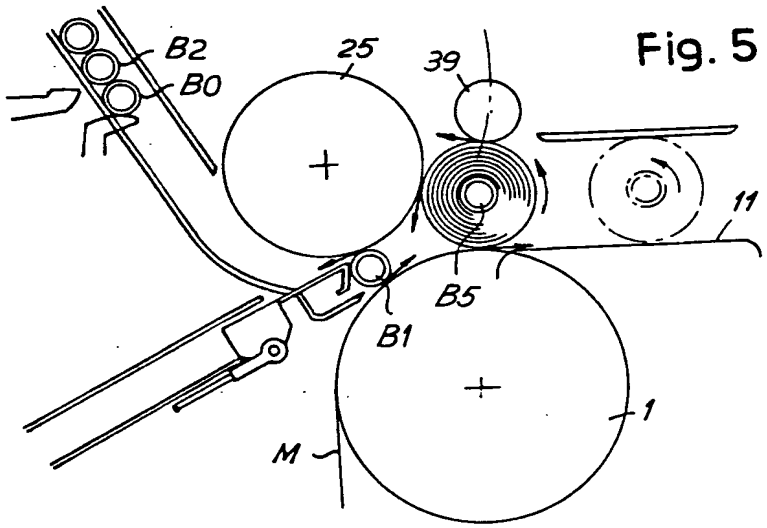

Fig. 5

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Sheet 4

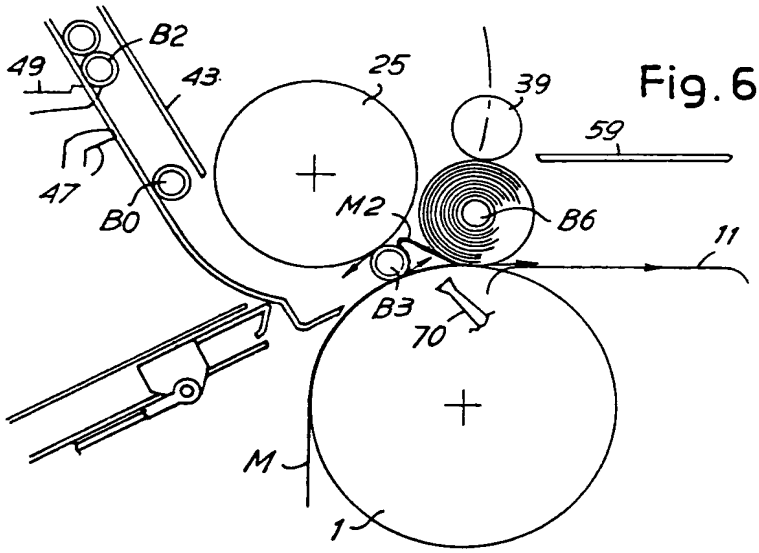

Fig. 6

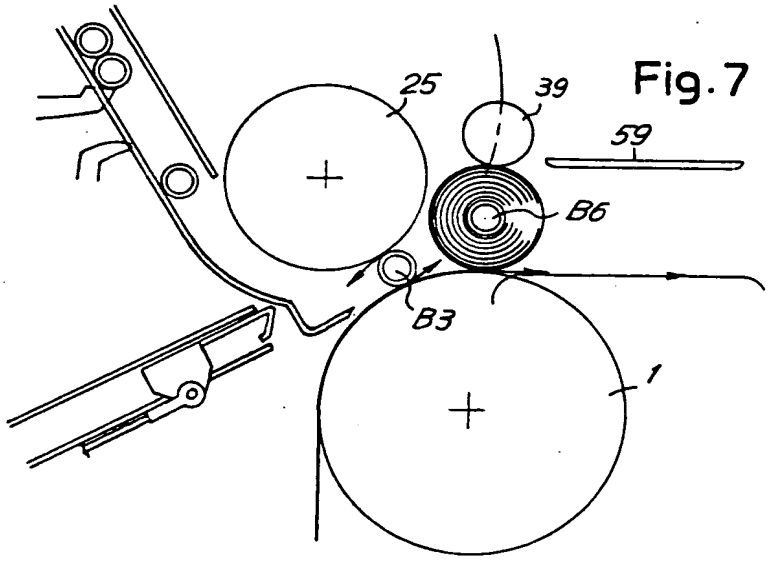

Fig. 7

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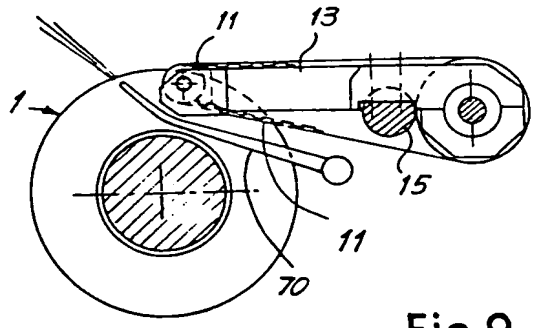


Fig.9

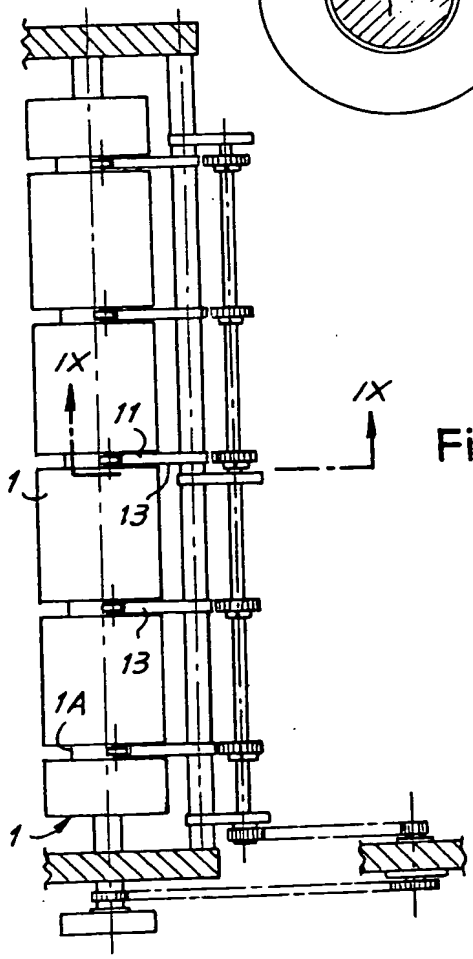
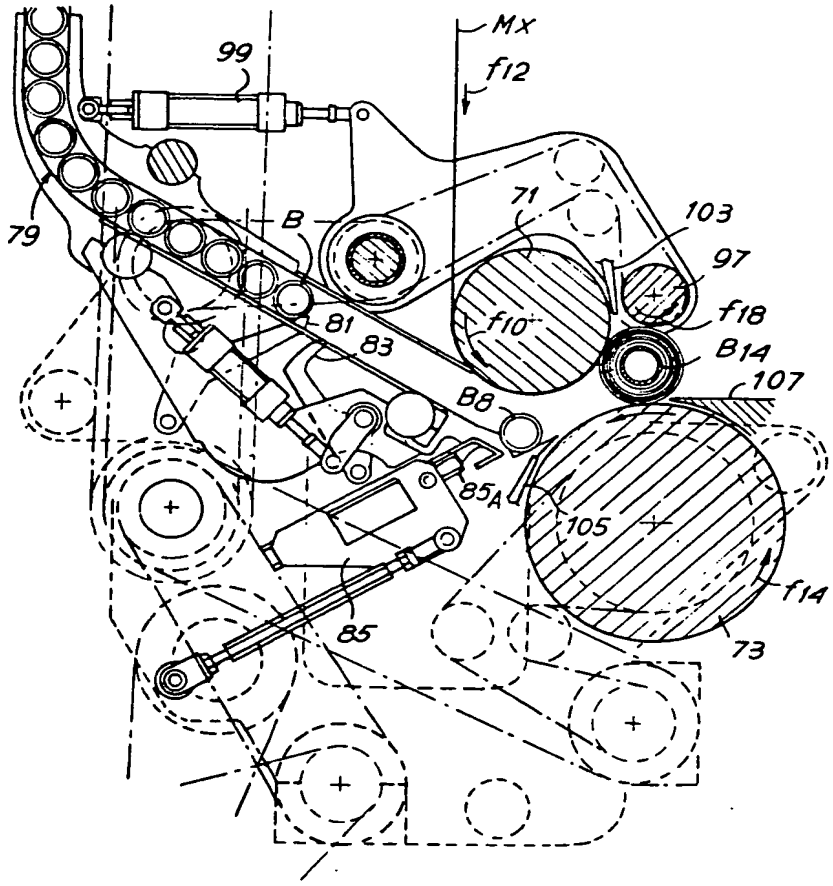


Fig. 8

Fig. 10



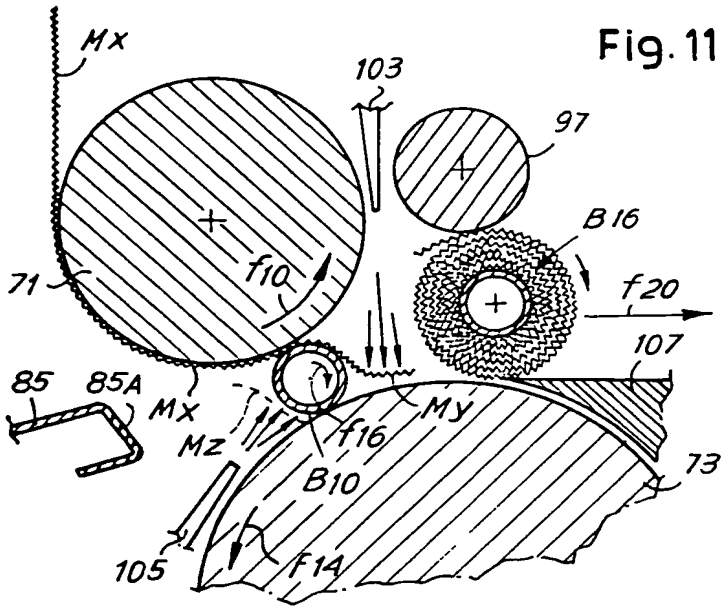

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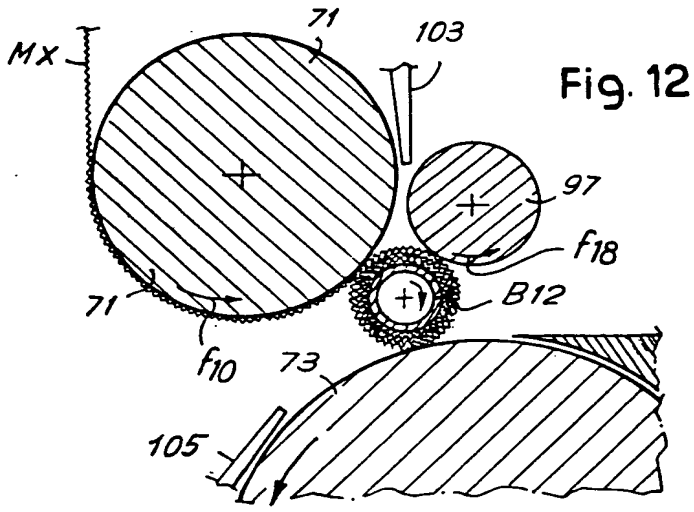
Fig. 11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73
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Fig. 12

(12) UK Patent Application (19) GB (11) 2 105 687 A

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(54) Separating perforated web on completion of rewinding

(57) In the high speed rewinder a parent roll of paper (26) unwinds from a back-stand to feed a wide web of paper to a perforating means, (36,37), web separation means (42,43), core-feeding means (71) and roll rewind means (77). The perforating means includes a stationary ledger blade (38) and a rotating knife-blade roll (37) which cut lines of perforations across the web. The web separation means includes a pair of operatively opposed rolls (41,43) rotating in synchronism, one of which has a spiral groove (42) therein and the other of which has means (see Fig. 12) arranged to force the web of paper into the groove to tear the web within the groove. A secondary winder roll (77) is disposed in spaced relation to the first winder roll to define a throat. A core advancing means (81) is arranged, periodically, to bring a core (72) into the throat, which is narrower than the outer diameter of the core. The secondary winder (77) roll can be slowed down to cause the core (72) to advance through the throat and pick up the leading edge of the web. A diameter control roll (95) is disposed near the secondary winder roll to limit the outer diameter of the finished roll of paper with a predetermined length of web being wound on said core. Cam control means (see Fig. 10) regulate the rotary speed of the perforation roll (37), the main-winder roll (41), the web separation roll (43), the secondary winder roll (77), the diameter control roll (95) and the core (72) so that a precise length of paper web will be wound on the core, differential speed between the secondary winder roll (77) and the diameter control roll (95) will move the finished log into a log receiving means and differential speed between the first and second winder rolls (41,43) will advance another core into the throat to pick up the leading edge of the just-severed web, advancing the core and web through the throat to repeat the sequence.

GB 2 105 687 A

SPECIFICATION

Web winding apparatus and method

The present invention relates to equipment for winding webs of sheet material such as paper, plastic, metal foil, etc., as well as to the method for winding such webs, and relates more particularly to equipment for re-winding big rolls of paper into smaller rolls, which equipment is known in the paper industry as a high speed automatic rewinder.

In the production of toilet tissue, absorbent kitchen towels and other sanitary paper products sold in roll form, it is customary to manufacture the webs of paper in large "parent" rolls on massive paper-making machines. These "parent" rolls may be as large as five feet in diameter and ten to twelve feet in length and, because the paper is extremely thin and light-weight, may contain several miles of paper web.

In order to produce a commercially saleable and easily marketable product, these large "parent" rolls must be rewound into smaller household-size rolls of the type commonly found in kitchens, bathrooms and public toilets around the world. The machine to produce these smaller rolls is called a "re-winder" and although it is under the control of a machine operator, it is generally known as an automatic re-winder because the machine runs continuously, producing from one "parent" roll hundreds of "logs" of small diameter (approximately 4—5 inches) on a cardboard tube or core 10 to 12 feet in length. The web is also perforated into sheet-size sections. All this is done under the pre-controlled settings of the machine once the "parent" roll of paper is installed in the re-winder and the machine is started. Hence the use of the phrase "automatic re-winder". The "logs" are automatically removed from the re-winder and subsequently cut into individual smaller rolls.

It is important in the economy of this industry that such automatic re-winders operate at high speed and produce finished logs of uniform diameter, accurate sheet-count and sheet-length, while at the same time insuring the quality of the product with regard to appearance and also for subsequent handling in packaging machines.

From the foregoing it is evident that of primary importance in this field of endeavour is the provision of effective high-speed equipment which can produce the roll products accurately and efficiently. However, it is equally important that the equipment and the processes be relatively inexpensive and economical to operate.

Although the prior art is replete with disclosures of high speed automatic re-winders, not all of them have been dependable or economical. The present invention provides an apparatus and method for re-winding webs automatically under conditions heretofore not achievable by the prior art devices.

Of particular inportance is the provision of devices to provide a "cut-off" of web under controlled conditions so that an absolutely accurate sheet count (or sheet length) is achieved. It is also important that the leading edge of the severed web be transferred to a newly-positioned core rapidly and repeatedly. Further, the diameter of the finished roll or log must be carefully and accurately controlled (despite variations in bulk, caliper, softness, extensibility etc. of the paper).

The prior art of some importance in this field; over which the present invention is an improvement, includes not only British Patent 1,435,525 French Patent 2,193,387, German Patent 2,335,930 and Italian Patent 963,047 but also U.S. Patents Re. 28,353, 3,247,746, 3,264,921 and 3,179,348 (the latter of which are assigned to the Paper Converting Machine Company of Green Bay, Wisconsin), No. 3,540,671 (which is the property of Jagenberg of Germany), 3,148,843 (which is the property of the Hudson-Sharp division of Food Machinery Corp.) and 3,123,315 (which is the property of Dietz Machine Company).

Summary of the invention

The automatic high-speed winder of the present invention includes a "back-stand" which is capable of holding and rotatably supporting a large "parent" roll of web material such as toilet tissue, kitchen towels or the like. The back-stand includes a roll-rotating arrangement and the web is fed from the "parent roll" to a perforating station where rows of slits are made across the web at spaced intervals (approximately 4 to 5 inches between the rows of slits) to define the sheet length of the finished product.

After the web has been perforated, the leading edge of the web is transferred to a cut-off roll. The web is wrapped partially around the cut-off roll and then the leading edge is transferred to a small diameter cardboard tube or core. The leading edge is adhesively (or otherwise) secured to the core and the final winding state is completed to provide a long "log" or roll of paper wound on the core, with the required number of sheets (as defined by the perforations) and required outer diameter.

Thereafter the "tail" of the roll is severed from the web and the new leading edge of the web (just severed from the tail) is transferred to another core, automatically, and the sequence is repeated until the parent roll of paper is completely made up into "logs".

Thereafter a new parent roll is inserted into the back-stand and the procedure repeated.

With the foregoing considerations in mind, it is evident that critical aspects of the production of such paper products or other web-like material are: (1) the efficient and economical operation (at high-speed, with a wide web of paper) of a machine to produce cleanly cut perforations which define sheet-length, (2) the severing of the web along a precise line as determined by sheet-count or roll-length, (3) the timely introduction of the cores to the winding mechanism at the appropriate location, as well as the automatic removal of the finished "logs.

Therefore, a principal object of the present invention is to provide, in a continuous high-speed automatic re-winding machine, a cut-off mechanism which cleanly and precisely severs a wide, fast-moving web of paper in a precise location along the web.

Another object of the present invention is to provide an automatic high-speed re-winding machine which produces exact sheet-count and sheet-length in the re-wound smaller rolls of paper.

Another object of the present invention is to provide a cut-off mechanism in an automatic high-speed web re-winder which is inexpensive, easy to maintain at low cost, easy and inexpensive to replace and which operates at a low noise level.

Another object of the present invention is to provide a cut-off roll for an automatic high-speed re-winder which maintains control of not only the trailing edge of the just-cut web but also the leading edge of the advancing web as the new leading edge of the sheet is transferred to another core.

Another object of the present invention is to provide a control mechanism for an automatic re-winding device which operates without a mandrel for the core and which also controls precisely the final diameter of the finished roll.

Another object of the present invention is to provide, in an automatic continuous re-winder a tail-sealing or tail-tacking arrangement which insures that the trailing edge or tail of a just-severed web is securely retained against the outer diameter of the roll.

Still further objects of the present invention are to provide a cut-off mechanism in an automatic web re-winder which transfers the leading edge of the web to a core, selectively with adhesive, or by use of vacuum, electrostatic principles, mechanical devices, pressure means, etc., at the election of the machine manufacturer.

Apart from the principal object above, the other objects represent optional and not essential features of the invention.

Examples of the invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a vertical cross-sectional view of the automatic continuous high-speed re-winder of the present invention;

Figure 2 is a schematic vertical cross-sectional view of the main winding drum and associated parts of the sheet-severing portion of the re-winder shown in Figure 1;

Figure 3 is a schematic view, similar to Figure 2, showing the initial position of the leading edge of the web secured to the main winding drum;

Figure 4 is a schematic view, similar to Figure 2, showing the main winding drum rotated so that the leading edge of the web has passed the web severing roll and is moving toward the core position;

Figure 5 is a view, similar to Figure 2, illustrating the core in web-receiving position between the main winding drum and diameter-control roll;

Figure 6 is a view, similar to Figure 2, showing the finished roll departing the winder position, the tail of the web separating from the winding drum and the new leading edge of the on-coming web partially wrapped around the core;

Figure 7 is a view, similar to Figure 5, illustrating the arrangement of the main winding drum when there is no fold back of the leading edge of the web, and the transfer is made straightaway to the core;

Figure 8 is a view, similar to Figure 6, illustrating a modified type of core-advancing mechanism and modified secondary winding drum to provide yet a different mechanism for wrapping the leading edge of the web around the core;

Figure 9 is a fragmentary cross-sectional view of that portion of the main winding drum which includes the web-severing means;

Figure 10 is a vertical end-view of the cam-section of the control mechanism which regulates positions of the various rolls shown in Figures 1—7 inclusive;

Figure 11 is a cross-sectional view of the web-separator device of the present invention;

Figure 12 is a cross-sectional view of a portion of the web-separator roll and of the main winding drum at the moment of interaction of the two rolls to separate the web;

Figure 13 is a schematic, perpective view of the means for driving a perforating roll at an angle to the power shaft;

Figure 14 is a fragmentary view of the variable roll-diameter-control mechanism;

Figure 15 is a cross-sectional view taken generally along line 15—15 of Figure 14; and

Figure 16 is a schematic view of the synchronism mechanism for the web-separation device.

Referring now to Figure 1, the re-winder 21 includes a first frame section 22 and a second frame section 23, spaced apart, to provide a passageway or aisle 24 which permits the machine-operator to pass between the two sections. A back-stand 25 supports a parent roll 26 of paper web which is unwound from the parent roll axle 27 supported in a cradle 28 in the back-stand 25.

The roll 26 is supported for rotation on the axle 27 and is unwound therefrom by a driven unwind belt 30 supported in the frame 22. The belt 30 is appropriately driven by any well-known means (not here described in detail) which causes the belt 30 to move in the direction of the arrow 31 during the operation of the rewinder. The belt 30 is appropriately controlled by the drive means so as to insure that the linear speed of the web 29, as it unwinds from the roll 26, is precisely controlled and maintained in accordance with the demands of the rest of the re-winder system.

Appropriate tension on the web 29 as it moves from the back-stand frame portion 22 to the front

winder portion 23, in the direction of the arrow 32, is controlled by the dancer roll 33.

As the web 29 moves in the direction of the arrow 32, is passes into the winder section 23 over a pair of guide rolls 34 and 35 and then moves vertically from the guide roll 35 through the perforating station which consists of a stationary support 36 for a ledger blade, and a rotating knife-blade roll 37.

The support 36 includes a notched perforating blade 38, appropriately mounted thereon, and operating in conjunction with a plurality of cutter knives 39 so as to provide a line of slits across the entire width of the web 29. This perforating roll mechanism may provide the "clean-cut" perforation well known in the art and needs no further description here.

However, it is to be noted that the web 29, while passing through the perforating station does not "wrap" the roll 37 and therefore the linear speed of the web 29 as it passes between the two blades may be either greater or less than the peripheral speed of the roll. This arrangement enables the operator to vary the distance between the rows of perforations and does not limit the distance to the circumferential distance between the knife blades 39. For example, if the linear speed of the web 29 is increased as it passes the ledger blade 38 there will be a greater spacing than the distance between knife blades 39 on roll 37. This result may be obtained either by decreasing or increasing the peripheral speed of the roll 37 with respect to the linear speed of the web 29 or by increasing or decreasing the web speed with respect to the peripheral speed of the roll. If the linear speed of the web 29 is decreased, the distance between rows of perforations will be decreased.

It is to be understood that the difference between the linear speed of the web 29 and the peripheral speed of the roll 37 is not limitless without a tendency for the blades to tear the web 29. Nevertheless, the arrangement shown in Figure 1 provides flexibility for the user of the machine to change the dimension of the sheets and the distance between lines of perforation in the finished product.

When the web has moved through the perforating station it then passes around a turning roll 40 into contact with the outer surface of the main winding drum 41. This main winding drum 41 will be described in further detail hereinafter.

It will be noted that the web 29, as it comes into contact with the surface of the main winding drum 41, has the leading edge of the web held in contact with the surface of the main winding drum 41 by a vacuum within the drum 41 and which exerts its force through the apertures 42 to hold the web against the outer surface of the drum.

As the main winding drum 41 rotates (in a counter clockwise direction as shown in Figure 1), the web passes the web separation roll 43 which is supported for rotation on arms 44 so that the roll 43 may move towards or away from the main winding drum 41. In Figure 1 of the drawings, the roll 43 is shown in a position spaced from the main winding drum. The web-separating mechanism is mounted on the roll 43, and this may include a cut-off knife (well known in the art) or may include a web separating device 45 which operates in conjunction with a channel 46 in the main winding drum 41.

At an appropriate moment the roll 43 swings toward the main winding drum 41 under the inpetus of the arm 131 which is connected to the rocker shaft 47. The rocker shaft 47 is indirectly connected (through mechanism not shown) to the rotatable shaft 48 (shown in Figure 10). This shaft 48 is operatively connected to a cam follower 49 which bears against the edge 50 of the cam 51.

The cam 51, as well as the other cams hereinafter to be described, are mounted on the drive shaft 52 of the cam-control section of the machine and, as the shaft 52 rotates, the cams mounted thereon are turned to operate the web-separation mechanism, core lifter, secondary winder deceleration, and diameter control roll.

Referring once again to the web-separation mechanism shown in Figures 1 and 10, as the cam 51 is rotated, the roll 43 is swung toward the main winding drum 41 and, inasmuch as the drums 43 and 41 are rotated in synchronism, the web-separator 45 and the channel 46 will come together for an instant at position 53 which is on a line between the axis of the main winder drum 41 and the web-separation roll 43.

The device for maintaining the rolls 41 and 43 in synchronism is shown in Figure 16. A double-faced timing belt 132 wraps around a toothed portion of the main winding drum 41 and beneath the toothed portion of the web-separation roll 43. A tension roller 133, carried by a pivoted arm 134 and urged by spring 135 in the direction of arrow 136, causes the belt 132 always to be under tension and held tightly against the toothed portions of the drums 41 and 43 even though the drum 43 may be urged by the arm 44 and the web-separation rocker shaft 47 both toward and away from the main winder drum 41.

Referring now to Figure 9, it can be seen that when the roll 43 is brought against the main winding drum 41, the web separation mechanism 45 depresses the paper web 29 into the channel 46 causing the web to tear or separate within the channel. The web separation may take place with or without a line of perforations overlying the channel 46.

This phenomenon is created because the extent to which the web 29 is pushed into the channel 46 by the web-separation mechanism 45 exceeds the stretch and tensile strength of the paper web.

It is understood that stretch and tensile characteristics of paper webs differ and that the webs may therefore rupture with more or less extension caused by the web-separator 45. However, the width and the depth of the channel 46, as well as the dimensions of the web-separator 45 can be chosen so that the

relationship between the dimensions of the separator 45 and the channel 46 are appropriate for the type of paper to be run on the re-winder.

Further details of the web-separator are shown in Figures 11 and 12. The web-separator 45 consists of a rigid blade 54 which extends radially outwardly from the roll 43. This blade may have a base portion 55 which is secured to the roll 43, in a recess 56, if desired, or against the surface of the roll 43, if that is more desirable, by the screws 57.

Surrounding the blade 54 is a compressible member 58 which may be made of foam rubber, polyurethane or resilient material and which, preferably, envelopes the blade 54 but also has clamping portions 59 and 60 adjacent thereto.

As can be seen particularly in Figure 12, the web-separator 45 is located on the roll 43 so that the blade 54 will extend generally centrally into the channel 46. The distance that it extends into the channel 46 is a matter to be determined by the type of paper to be used in the machine and the distance that the web must be depressed into the channel 46 to cause it to rupture. In any event, the tip of the blade 54 does not strike the bottom of the channel 46 and, indeed, it is separated sufficiently from the side-walls of the channel 46 so that there is no likelihood of contact of the blade 54 with any portion of the main winding drum 41.

Both the channel 46 and the web separator 45 are spirally formed in a helix in opposite directions around their respective rolls (in a manner well known in the art) so that at any one instant only a short length of channel 46 and web separator 45 are in contact. This minimizes impact forces, separation energy, noise and wear.

The upper surfaces 61 and 62 of the clamping portions 59 and 60 are disposed to come into contact with the web 29 and to press the web tightly against the surface of the main winding drum 41 on each side of the channel 46, as is shown particularly in Figure 12.

The compressible member 58 preferably has slits 63 therein, on each side of the blade 54 so that the central portion 64 of the compressible member may easily enter the channel 46 (along with the blade 54) and press the web 29 into the channel 46. This takes place while the clamping portions 59 and 60 are pressing the web 29 tightly against the face of the main winding drum on each side of the channel 46.

Although the blade 54 may be covered at its tip by a portion of the central section 64 of the elastomer 58 so that only the elastomer comes into contact with the paper, in the alternative, the edge of the blade 54 may be sharp and protrude through the elastomer so that it also acts as a cutting edge to help rupture the paper in the channel 46.

It is to be further understood that the web 29 may be held against the surface of the main winding drum 41 at places other than along the edges of the channel 46. For instance, it is possible to eliminate the portions 59 and 60 of the elastomer 58 (retaining only the central portion 64 which depresses the paper into the channel 46) and hold the web 29 in place against the surface of the main winding drum by vacuum mechanism and holes placed closely adjacent to channel 46 (or by any other separate mechanism not an integral part of the web-separator means 45). It is important only that the web 29 be held tightly in an area closely adjacent to the channel 46 at the time that the web-separating means 45 presses the web into the channel 46 until the web stretches beyond its elastic and tensile strength within the channel, rupturing the web in the limited area of the channel 46.

After the web is ruptured, continued rotation of the main winding drum 41 carries the leading edge of the sheet counter-clockwise to the position shown in Figure 4. The leading edge of the web 29 flys rearwardly because it is floating free and is not held against the drum 41 except at the holes 42 where the vacuum created within the main winding drum 41 tightly holds the sheet against the surface.

There is illustrated at 65 in Figure 4 how the leading edge of the sheet flys rearwardly as the main winding drum 41 carries the web counter-clockwise. At this time a series of short arcuate recesses 66 are exposed on the outer surface of the main winding drum 41. These recesses 66 are described hereinafter.

Also as seen in Figure 4, the vacuum ports 67 provide conduits through which the vacuum within the main winding drum is effected against the trailing edge or tail of the web 29, keeping that portion of the sheet in contact with the surface of the main winding drum until the ports 67 pass the vacuum box wall 68 which divides the vacuum area 69 from the non-vacuum area 70 within the main winding drum 41. This position is shown in Figure 5.

Referring once again to Figure 1, it can be seen that while the main winding drum 41 is rotating counter-clockwise and carrying the leading edge of the web counter-clockwise with it, an elevator 71 is carrying a plurality of cores 72 from the core loading station 73 upwardly in the direction of the arrow 74 so as to position a leading core 75 directly beneath the main winding drum 41 and into juxtaposition with the throat 76 formed between the main winding drum 41 and the secondary winding drum 77.

The leading core 75 falls into the hopper 78 and is lifted upwardly therefrom by the rollers 79 on the arm 80 of the core-lifting mechanism 81.

The core lifting mechanism 81 is fastened to a shaft 82 which, as is shown in Figure 10, is directly connected to the cam follower 83 which bears against the cam plate 84 mounted on the core-lifter cam 85.

The dimensions, position and timing of the core-lifter cam 85 are such as to lift the rollers 79 within the hopper 78 and push the leading core 75 into the throat 76 just as the folded back portion 65 of the leading edge of the web 29 is

brought into juxtaposition with the core in the throat (as is shown in Figure 5).

Prior to the cores reaching the position of leading core 75 shown in Figure 1, they have passed between the rolls 86 and 87 of the glue applicator station 88. The glue applicator station 88 applies a plurality of peripheral stripes of glue to each core as it passes between the rolls 86 and 87, in locations and positions selected by the machine builder and appropriate to the type of paper to be secured to the core.

The elevator 71 is intermittently operated with dwell positions selected so that the cores move between the glue rolls and stop after the glue is applied. The rolls 86 and 87 rotate in the direction of the arrows at differential speeds so as to rotate the core between them during its passage and thus deposit glue around the entire circumference of the core. Roll 86 rotates faster than roll 87.

As the core rises from the glue application position shown at 89 (between the rolls 86 and 87), the glue remains tacky until it is lifted by the rollers 79 into the throat 76.

Once the leading core reaches the throat 76 (as is shown in Figure 5), the core surface comes into contact with the outer surface of the main winding drum and also the secondary winding drum and is thus caused to rotate at the same surface speed of these drums so that when the folded-back leading edge 65 of the web is brought between the core and the main winding drum the adhesive stripes on the core will immediately contact the folded-back leading edge of the web and cause the web to stick to the core, thus pulling the leading edge of the web away from the main winding drum (where it was held in place by the vacuum applied through the ports 42).

The secondary winding drum has a plurality of peripheral grooves (not shown) which are in alignment with the peripheral stripes of glue on the core (and indeed in alignment with the recesses 66 on the main winding drum) so that no glue is transferred from the surface of the core to the surface of the main winding drum or the secondary winding drum.

In the short period of time that elapses as the leading core is lifted into the throat 76 and the folded portion 65 of the leading edge of the web contacts the glued surface of the core, the trailing edge or tail of the web (which had heretofore been held in place against the drum at the channel 46 by the vacuum at the ports 67) passes over the non-vaccum area 70 and thus the tail or trailing edge of the already wound roll 90 is released from the main winding drum.

At this instant the secondary winder drum is caused to slow down or decelerate in its rotation. This deceleration is effected through the secondary winder drum deceleration cam 91 shown in Figure 10 which urges the cam plate 92 against the follower 93 and causes the shaft 94 to rotate. The rotation of the shaft 94 indirectly actuates a control mechanism which may be a series of tapered cone pulleys or a differential gear or a continuous-speed regulator which, through appropriate connections (not shown), causes the secondary winder drum to slow down with respect to the rotary speed of the main winder drum 41 and the diameter control roll 95.

The differential speed causes both the core 75 and the completed roll 90 to move forwardly. That is, the roll 90 moves out of position from between the secondary winder roll 77 and the diameter control roll 95 where it is discharged into a hopper 96. Continued movement of the hopper 96 round the axis of the shaft 82a will discharge the completed log of rolled paper into an appropriate log collector device (not shown).

Similarly, the deceleration of the secondary winding drum causes the main winding drum to force the core and newly-created leading edge of the web further through the throat 76 to a position above the secondary winding drum 77 whereupon the diameter control roll 95 is lowered into position on top of the newly placed core (and some length of paper) and the secondary winder drum is brought up to full speed and the winding of the new roll on a newly placed core can now take place.

From this point on the sequence is repeated, each newly placed core having a folded back leading edge of the web applied thereto and brought into position on top of the secondary winding roll and beneath the diameter control roll to form a new "log" of paper.

In Figure 7 the arrows 138 and 139 indicate positions where air-jets may be employed to assist in removing the tail from the main winding drum 41, either through the ports 67 (as by the jet 139) or externally against the web surface (by jet 138) in the space between the main winding drum 41 and the diameter control roll 95.

In Figure 8 there is shown still another form of device to assist in transferring the leading edge of the web to the newly positioned core. The secondary winding drum may have a plurality of ports or apertures 140 formed therein with a vacuum box 141 disposed within the secondary winding drum in the area closely adjacent to the throat 76. Appropriate timing mechanism (not illustrated) may be utilised to apply a vacuum within the box 141 to exert a suction through the ports 140 against the leading edge of the web as it begins to wrap around the core 75. It will be obvious from the drawing in Figure 8 that the vacuum system for assisting the transfer will not have any adverse effect upon the just-completed roll or the application or tying of the tail of the log.

There is illustrated in Figure 7 an optional form of application of the leading edge of the web to the core wherein an additional set of ports 97 may be provided within the surface of the main winding drum 41 to hold the very foremost portion of the leading edge of the web against the drum so as to prevent the fold back shown at 65 in Figure 4.

Under this circumstance, as the newly elevated core 75 is raised into the throat 76, some of the glue from the core is transferred to the tail of the

web which is about to be discharged from the main winding drum and this glue on the tail portion is used to "tie" the tail to the just-completed log. There remains sufficient adhesive on the core stripes to "pick-up" the next leading edge of the web and wrap it around the core similar to that shown in Figure 6.

Referring once more to Figure 10, the diameter control roll cam 98 (which is also mounted on the shaft 52) has a cam face 99 which urges the cam-follower 100 in a manner to rotate the shaft 101 and cause the diameter control roll 95 to be elevated above the log 90 under controlled conditions so as to control accurately the diameter of the log 90 as it is being wound between the secondary winder roll 77 and the diameter control roll 95.

Referring now to Figure 14, I have illustrated how the cam follower 100 will rotate the shaft 101 under the impetus of the cam follower face plate 99.

As the shaft 101 rotates it moves a connecting rod 102 in the direction of the arrow 103 causing the arm 104 to pivot about the axis 105. Also connected to the arm 104 is a ball-bearing roller 106 which itself bears against the underside of an arm 107, as is shown more clearly in Figure 15. When the ball-bearing roller 106 is caused to move by the arm 104 it elevates the arm 107 causing the shaft 108 connected thereto to move in the direction of the arrow 109. This shaft 108 is connected to the arm 110 of the bracket 111 which pivots on the axis 112 of the frame member 23. Other arms 113 pivoting about the axis 112 cause the connecting rods 114 to move up and down. Inasmuch as the connecting rods 114 are operatively connected to the diameter control roll 95, the roll 95 is accurately positioned above the log 90 and precisely controls the diameter to which the log 90 can be wound.

Referring once again to Figure 14, it can be seen that the arm 107 is pivotedly mounted on the axle 120 in a carrier 116 which is slideably mounted in the frame 117, as shown in Figure 15.

The hand wheel 118 connected to the screw-threaded shaft 119 causes the axle 120 to move right and left as shown by the arrow 121. This movement causes the arm 107 to pass above the ball-bearing roller 106 and thus change the distance between the center of the axle 120 and the axis 122 of the ball-bearing 106. This also changes the distance between the axis 122 of the ball-bearing 106 and the axis 123 of the pivot which is the lower end of the shaft 108.

Although I have provided a series of connecting points 124, 125 and 126 in the arm 110, (which positions 124, 125 and 126 can be used to make gross changes in the position and location of the diameter control roll 95), I have also provided the hand wheel 118 to make very fine, small adjustments in the location of the roll 95 by rotating the hand wheel 118.

The relocation of the upper end of the shaft 108 in any of the holes 124, 125 and 126 can only be accomplished while the machine is not operating, but the position of the arm 107 above the ball-bearing roller 106 can be adjusted by the hand wheel 118 while the machine is operating.

In Figure 13 I have shown a device for driving the knife blade roll 37 whose axis 127 is disposed at an angle to the axis 128 of the power drive roll 129. This device includes a double face timing belt 130 which travels around the drive roll 129, guide roll 137, knife blade roll gear 138, guide roll 139 and guide roll 140. The axes of rolls 137 and 140 are parallel to axis 128, while the axis of roll 139 is parallel to axis 127. The angle between axis 127 and axis 129 is approximately 1°—2°.

It will be apparent from all of the foregoing that an important aspect of this invention is the provision of means for accurate severance of a rapidly moving wide web of paper. This permits the positioning of a line of perforations above the channel 46 so that the separation always takes place at the end of a specific sheet, thus affording precise sheet-count in the finished log or roll of paper on the core.

Although the apparatus has been described for applying the glue to the core, it is to be understood that the glue may be applied to the web (as by a spray or other means) on the drum 41, immediately after the channel 46, thus eliminating the glue application rolls 86 and 87 and glue applicator station 88.

It is to be understood that the present invention may be embodied in other specific forms without departing from the spirit or special attributes hereof, and it is therefore desired that the present embodiments be considered in all respects as illustrative, and therefore not restrictive, reference being made to the appended Claims rather than to the foregoing description to indicate the scope of the invention.

Claims

1. In a rewinder constructed and arranged to receive a web of sheet material,

— a first winder roll having a spirally disposed channel in the surface thereof,
— a web separator roll having web separator means disposed in a spiral which is opposite to the spiral of said channel first winder roll,
— the channel in said first said winder roll and the means in said web separator roll constructed and arranged so that at selected moments the means and the channel are in operative juxtaposition to each other to move said web into said channel a distance in excess of the stretch and tensile characteristics of said web so as to tear said web in said channel.

2. The rewinder of Claim 1 wherein said web separator means is a compressible strip which forces the web into the channel.

3. The rewinder of Claim 1 wherein said web separator means is a rigid member which forces the web into the channel.

4. The rewinder of Claim 2 wherein a rigid

member combines with the compressible strip to force the web into the channel.

5. The rewinder of Claim 3 includes vacuum means on each side of the channel to hold the web against the first winder roll.

6. The rewinder of Claim 3 wherein portions of said compressible strip do not enter the channel but hold the web against the first winder-roll.

7. The rewinder of Claim 5 wherein the vacuum means is a plurality of ports disposed closely adjacent said channel in said first winder roll so as to hold the tail of said web adjacent the channel after the web separation takes place.

8. The rewinder of Claim 7 wherein a second set of ports is disposed in the surface of the first winder roll, on the other side of the channel so as to hold the leading edge of said web against said roll after web separation takes place but spaced sufficiently from the channel to permit a portion of said leading edge to double back upon itself between the said channel and the second set of ports.

9. The rewinder of Claim 7 wherein said second set of ports is disposed closely adjacent the said channel so as to hold the leading edge of said web against said first winder roll closely adjacent said channel and to prevent it from doubling back upon itself.

10. The rewinder of Claim 1 wherein the first winder roll and the web separation roll are operatively interconnected by drive means so as to rotate in synchronism, with control means to keep said rolls spaced apart while a length of said web passes therebetween but to bring said rolls together at a selected moment with said channel and said separation means in alignment.

11. The rewinder of Claim 1 including means for perforating said web along a line transverse to the line of movement of the web.

12. The rewinder of Claim 10 and Claim 11 wherein one of said lines of perforation overlies said channel when the rolls come together.

13. The rewinder of Claim 11 wherein the means for perforating said web includes a stationary blade and a plurality of cutter blades supported on a rotatable member.

14. The rewinder of Claim 13 including drive mechanism for rotating the cutter blade supporting member so as to change the peripheral speed thereof with respect to the speed of the web advancing through said perforation means and thus to change the distance between the lines of perforations in said web.

15. The rewinder of Claim 7 including a vacuum separator disposed within said first winder roll to prevent the vacuum from operating at said ports after said ports have passed said separator whereby to release said web from the surface of said first winding roll.

16. The rewinder of Claim 15 including an air-jet in the non-vacuum area of said first winder roll disposed so as to force air through said ports and assist in detaching the tail of the web from the surface of the first winder roll.

17. The method of winding a web of paper which includes passing said web between a pair of rolls, one of which has a spiral channel disposed spirally along the surface thereof and the other of which has a web separator means extending radially outward from the surface thereof in alignment with said channel and disposed to operate in conjunction with the first roll to press said web into said channel and to separate said web by tearing said web in said channel.

18. The method of Claim 17 which includes bringing a core into juxtaposition with said winding roll in alignment with the leading edge of a severed web and causing said leading edge to wrap said core and then winding said core and said web into a log.

19. The method of Claim 18 which includes the winding of said log under controlled conditions so as to precisely maintain the outer diameter of said log.

20. The rewinder of Claim 1 including

— a second winder roll disposed near said first winder roll so as to define a throat between the first and second winder rolls
— means for delivering a core at said throat
— core-advancing means constructed and arranged to feed the core into said throat
— the width of said throat being slightly less than the diameter of said core
— diameter control means disposed adjacent said second winder roll and constructed and arranged to overlie said core after it has passed through said throat
— speed-control means for said first winder roll, said secondary winder roll and said diameter control roll, operatively interconnected and arranged so that the first winder roll, the secondary winder roll and the diameter control roll may, it desired, rotate with the same peripheral speeds and
— also operatively interconnected so that the relative speeds of the first winder roll and the secondary winder roll may be varied so as to force a core disposed in said throat to pass between the said two rolls to a position between the secondary winder roll and the diameter control roll
— the first winder roll, the secondary winder roll and the diameter control roll being constructed and arranged so as to rotate at the same peripheral speeds, if desired, whereby to rotate the core and a web of paper thereon between them and thus to wind a web of paper upon said core,
— said diameter control roll constructed and arranged to move away from the secondary winder roll under controlled conditions whereby to constrain the web of paper and core between it and the secondary winder roll and thus to control the diameter of said core and web as it is wound into a log,
— the relative speed of the secondary winder roll and the diameter control roll being variable

with respect to each other so as to move the log from between the said two rolls at the precise instant when the web portion severed by the web separating means appears at the throat, and thus to discharge the log from between the secondary winder roll and the diameter control roll,

— said core advancing means arranged to move a second core into the throat at the moment of discharge of the log so as to pick up the leading edge of the separated web where it can be wrapped around said second core and advanced through said throat.

21. The rewinder of Claim 20 including glue application means for said core which consists of a pair of rolls, one roll rotating in a glue bath and having a plurality of raised portions to pick up said glue, the other of said rolls being a back-up roll, the space between the raised portions of said glue applicator roll and said back-up roll surface being slightly less than the diameter of a core, said rolls rotating at differential speeds so as to spin and transfer said core as it passes between said rolls and thus apply strips of glue around the entire circumference of said core.

22. The rewinder of Claim 20 including a core-receiving hopper disposed to hold a core beneath said throat until the separated portion of the web appears at the throat, core advancing means to bring said core from said hopper into said throat in alignment with the leading edge of the separated web as said first winding roll brings said leading edge into said throat whereupon the glue on said core picks up the leading edge of said web as core passes through the throat, causing the web to wind up on said core.

23. The rewinder of claim 22 including speed control mechanism to slow down the rotation of the secondary winder roll with respect to the rotation of the first winder roll at the moment when a core is advanced into the throat by the core advancing means whereby said first winder roll causes said core to pick up the leading edge of the sheet, rotate through said throat and wind the web upon the core; and thereafter the speed of rotation of the secondary winder roll is increased so as to be the same as the peripheral speed of the first winder roll causing the core to continue rotation at web speed and to wind a web thereupon into a log of paper.

24. The winder of Claim 20 including speed control mechanism for said diameter control roll and said secondary winder roll which causes the said rolls to rotate at the same peripheral speed and to wind a log of paper therebetween, and also including speed control means to decelerate the said secondary winder roll with respect to the speed of said diameter control roll thereupon to cause said log to be discharged from between said two rolls after the tail of the separated web has moved through said throat.

25. The winder of Claim 24 including drive means for said diameter control roll which precisely locates the diameter control roll with respect to the secondary winder roll whereby to control the diameter of the log of paper being wound therebetween, said diameter control roll moving away from said secondary winder roll as the diameter of the log of paper therebetween increases, the rotary speed of the diameter control roll and the secondary winder roll being the same until the completed log of paper is wound therebetween, whereupon the secondary winder roll is decelerated and the rotation of the diameter control roll is increased to cause the log of paper to be discharged from between said rolls.

26. The rewinder of Claim 20 wherein the diameter control roll position control mechanism includes variable adjustment to regulate the distance between the secondary winder roll and the diameter control roll while a log is being wound.

27. The rewinder of Claim 11 including a double-faced timing belt and at least one inclined guide-roll for said belt, said belt passing round a gear-portion of the rotating roll in said perforation means whereby to enable said rotating roll of said perforation means to be disposed at an angle other than 90° to the line of travel of the said web through said perforation means.

28. The rewinder of Claim 20 wherein vacuum ports and vacuum means are included in the secondary winder roll to assist in transferring the leading edge of the web to the core when the core is in the throat.

29. The rewinder of Claim 6 including means in the channel to resist entry of the web and blade.

30. The rewinder of Claim 1 wherein the web separator includes a sealing means on each side of the channel to hold the web in place, and means to move the web into the channel.

31. The rewinder of Claim 30 wherein the moving means is a vacuum.

32. The rewinder of Claim 30 wherein the moving means is a pressure.

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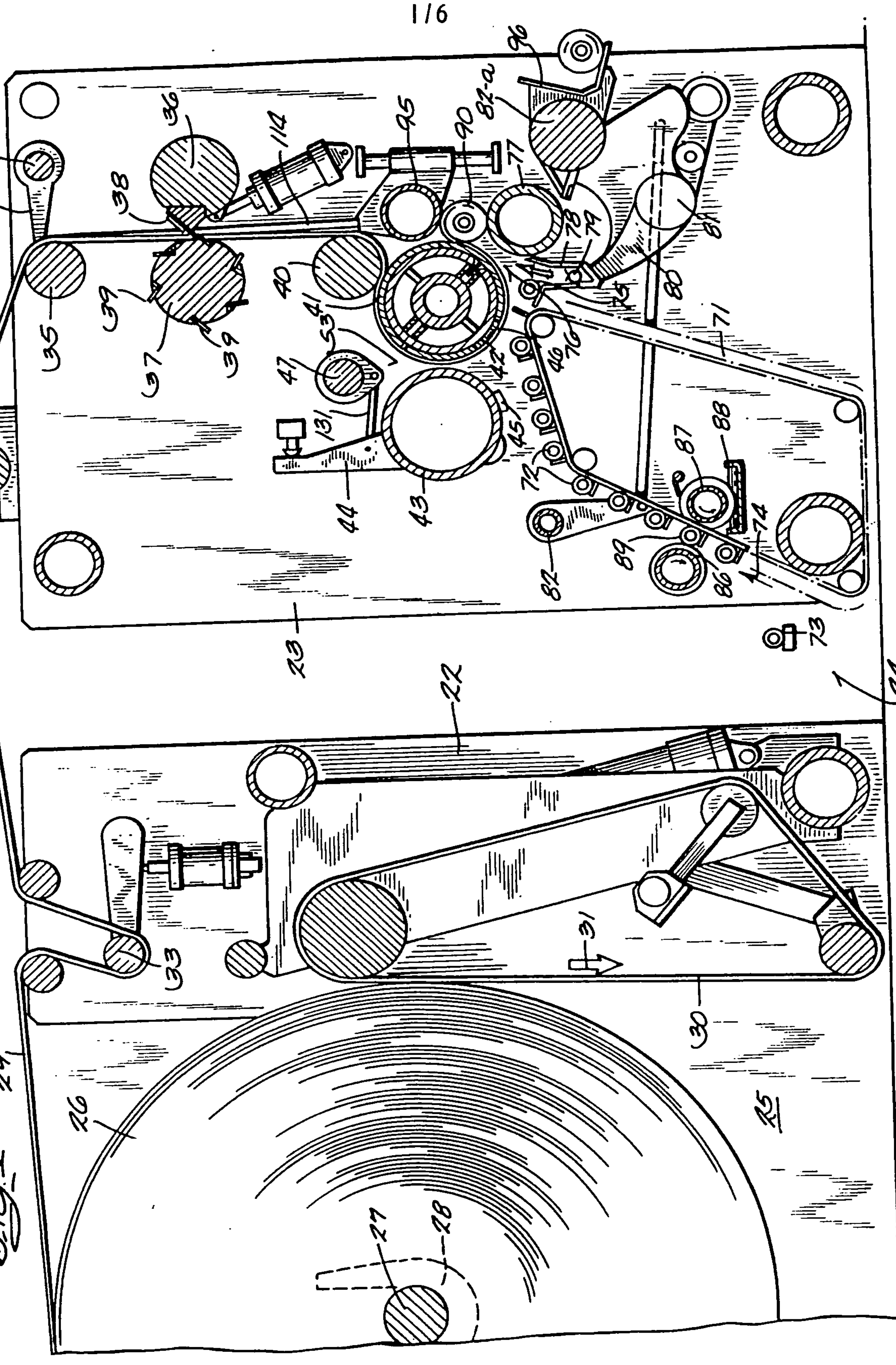
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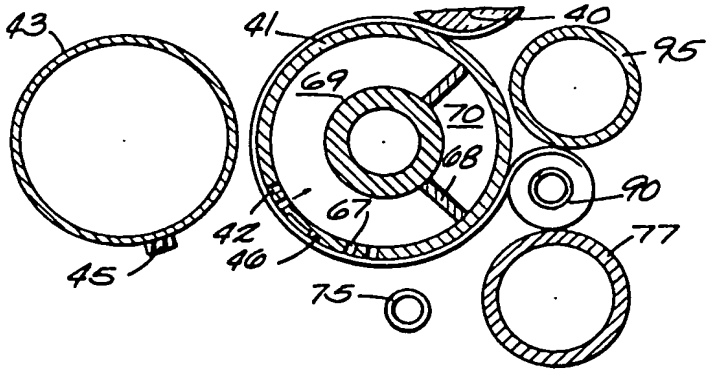
Fig.1

Fig. 2.



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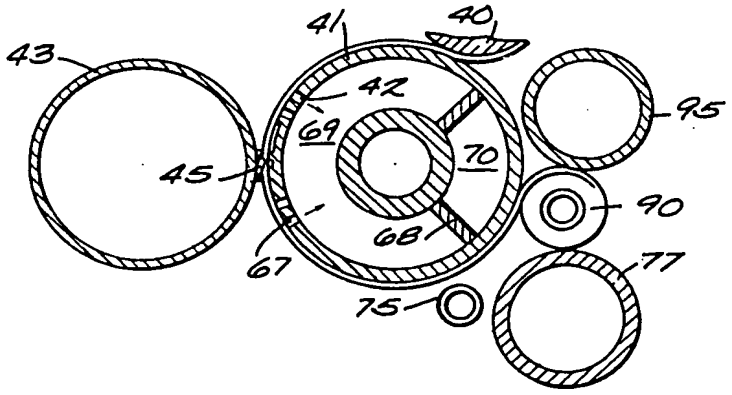

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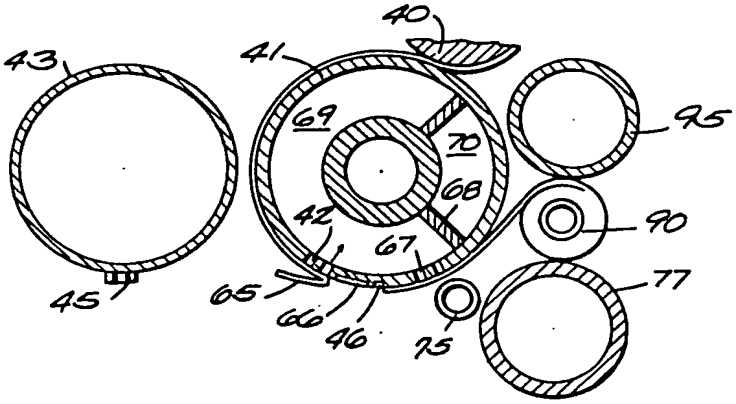

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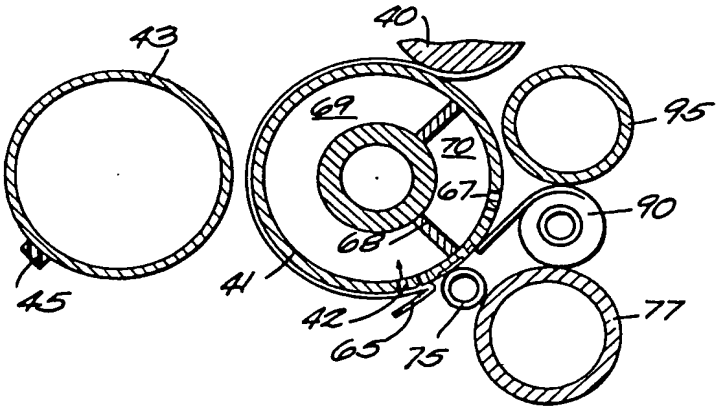

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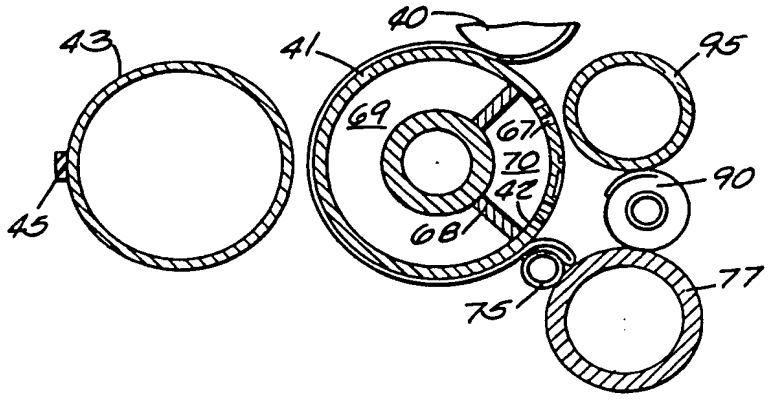
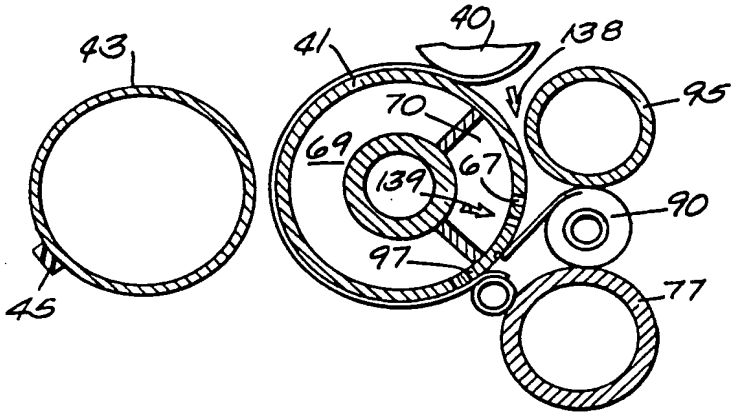


Fig. 7



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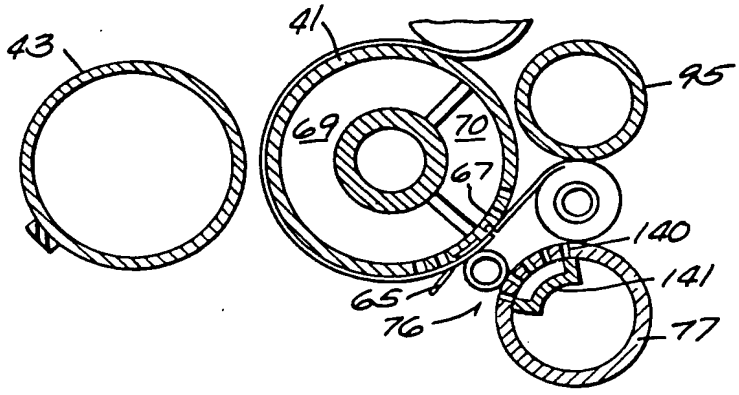

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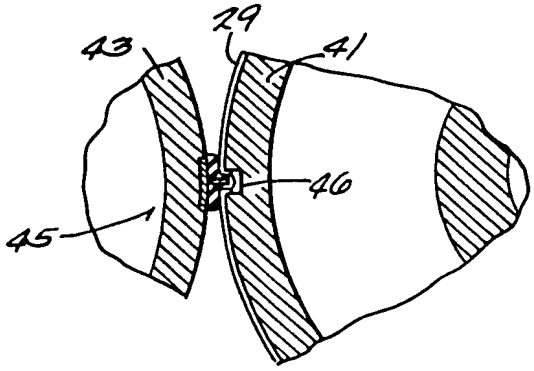


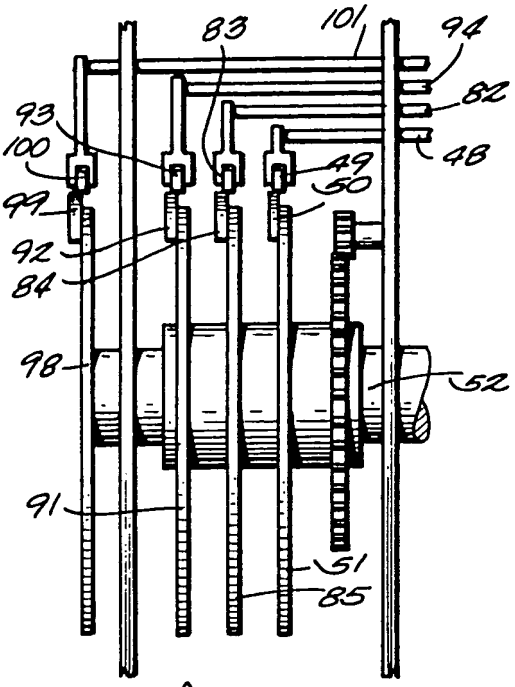
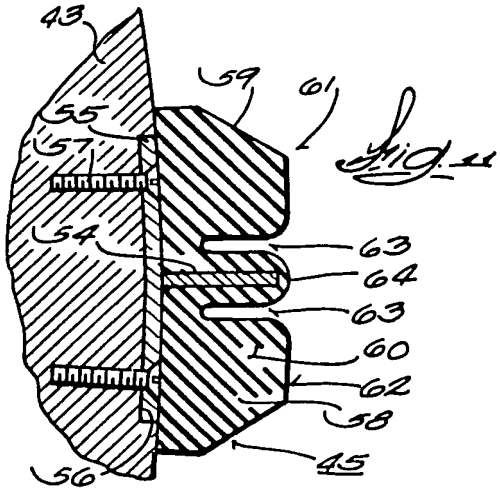


Fig. 10



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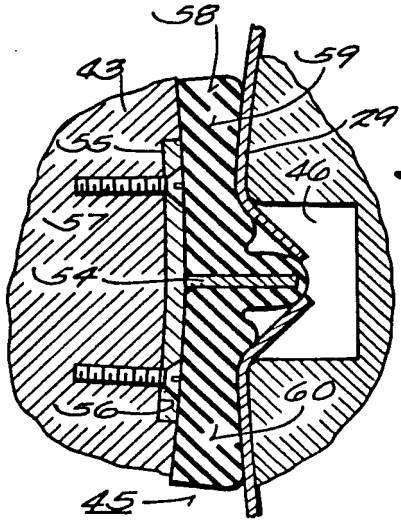
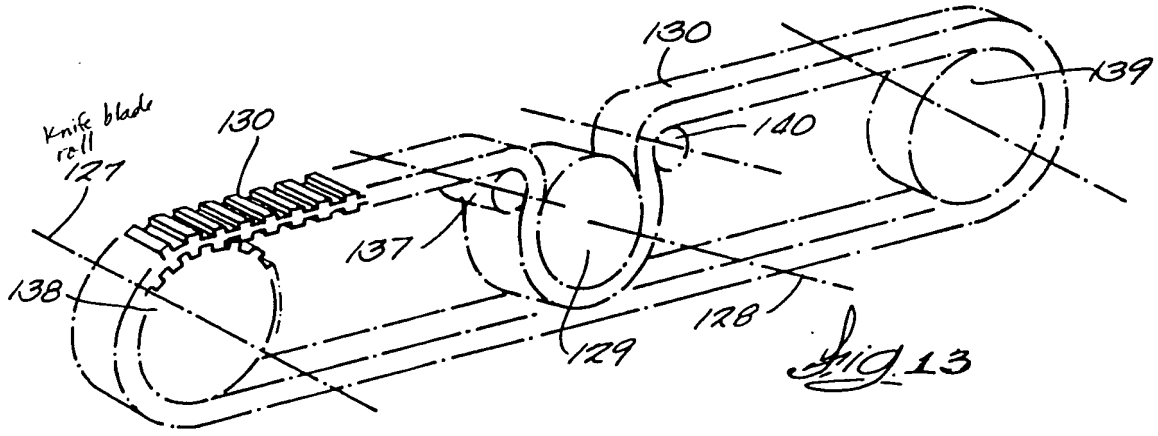


Fig. 12



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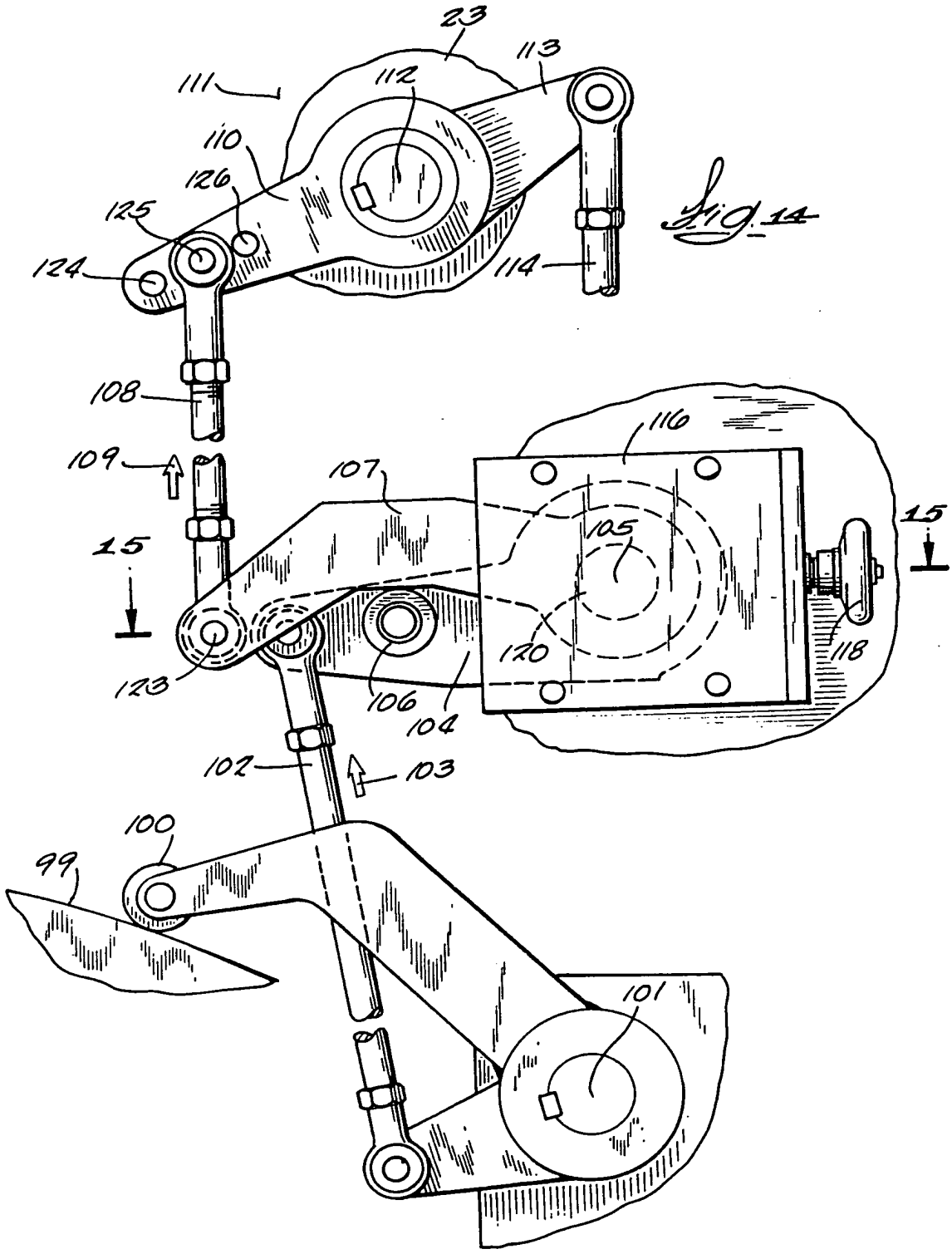
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Fig. 14

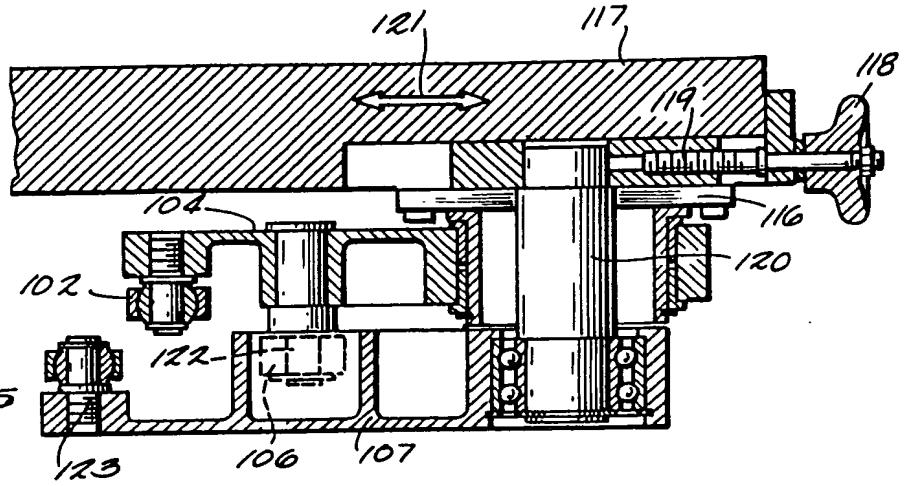
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Fig. 15

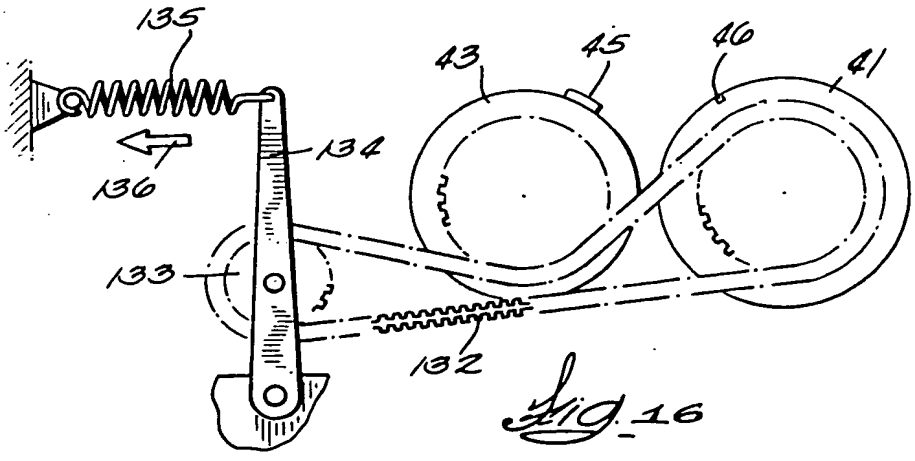
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Fig. 16

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B8R

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(54) Apparatus for winding onto cores and separating the web

(57) Web is wound onto cores which are introduced to the throat between first and second winder rolls (46,48) and which are advanced through the throat by causing the peripheral speed of second winder roll (48) to be slower than the peripheral speed of first winder roll (46). The web is guided around the first winder roll (46) and commences winding onto the core as it passes through the throat. A diameter control roll (69) acts on the web roll being wound and a differential speed control varies the peripheral speed of the diameter control roll (69) relative to the first and second winder rolls (46,48), eg to eject a fully wound roll between rolls (69 and 48) and separate the web. Alternatively, the speed of roll (69) is changed to cause the web roll to move the wound web roll towards a fresh core introduced through the throat, to trap the web between the fresh core and winder roll (48) and subsequently to separate the web. Perforating rolls (38,39) produce spaced lines of perforations across the web and the location of these lines can be varied by adjustment of the speed of rolls (38,39).

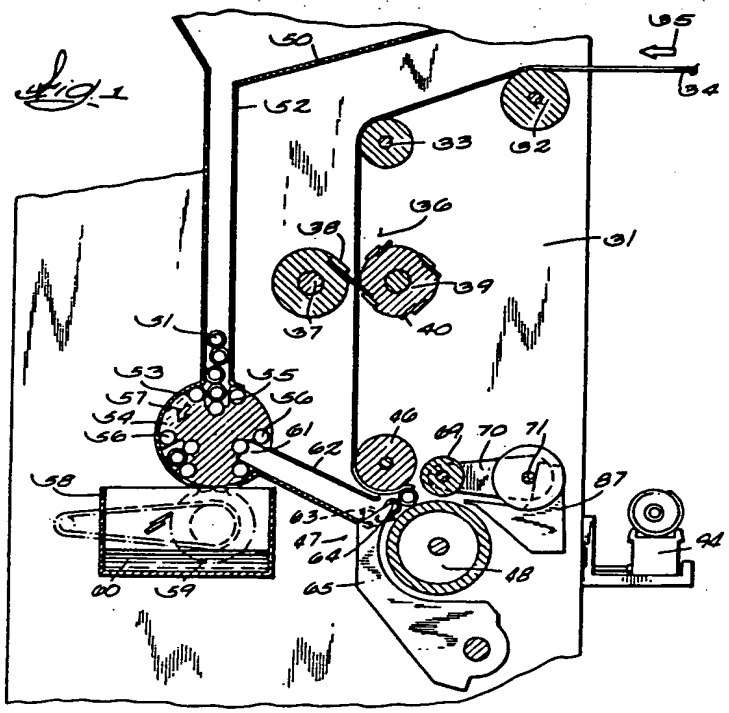

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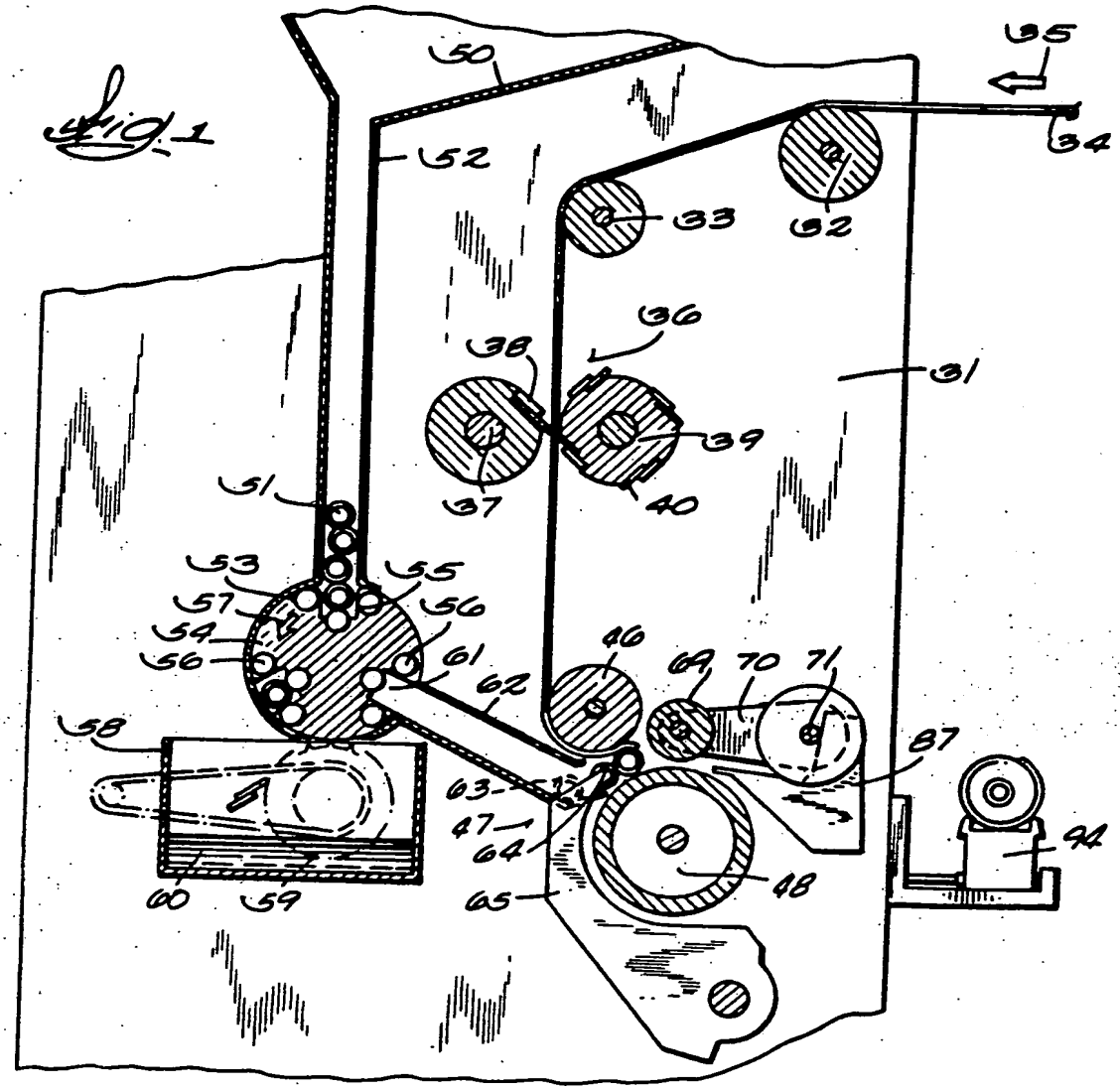
Fig. 1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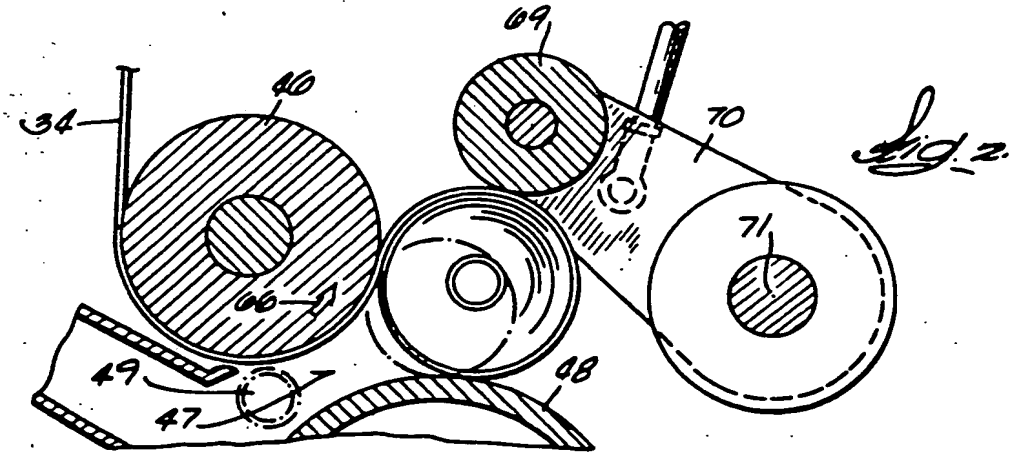
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Fig. 2

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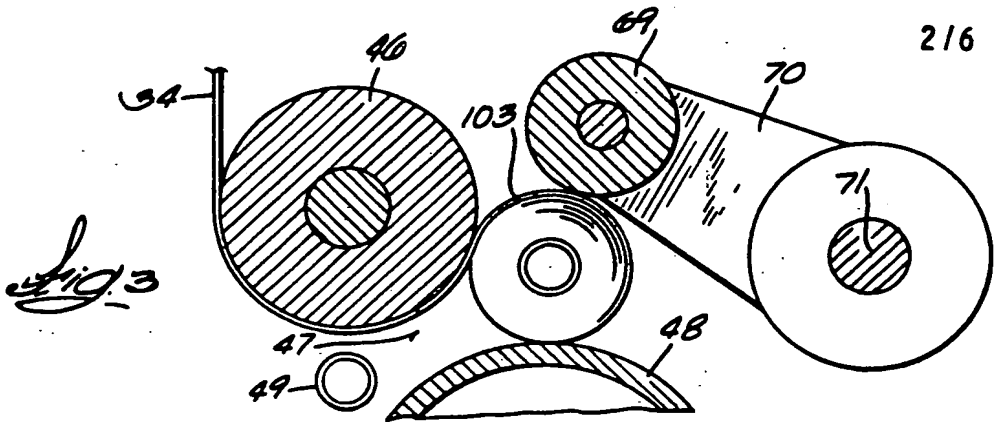

Fig. 3

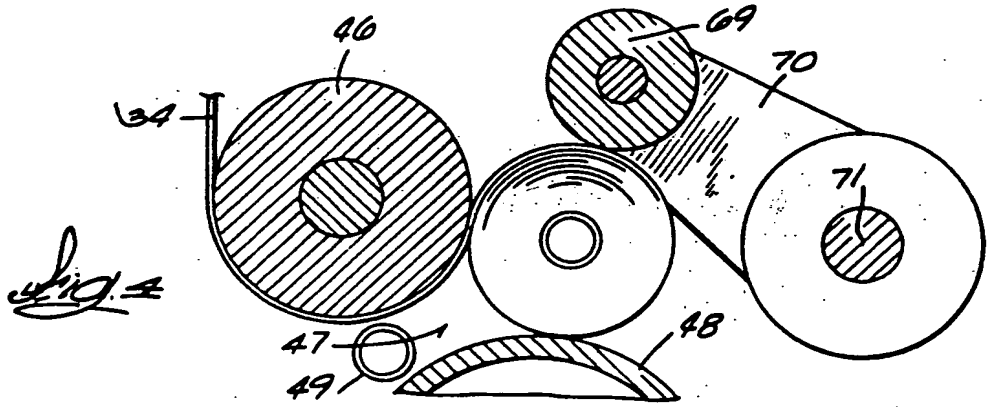

Fig. 4

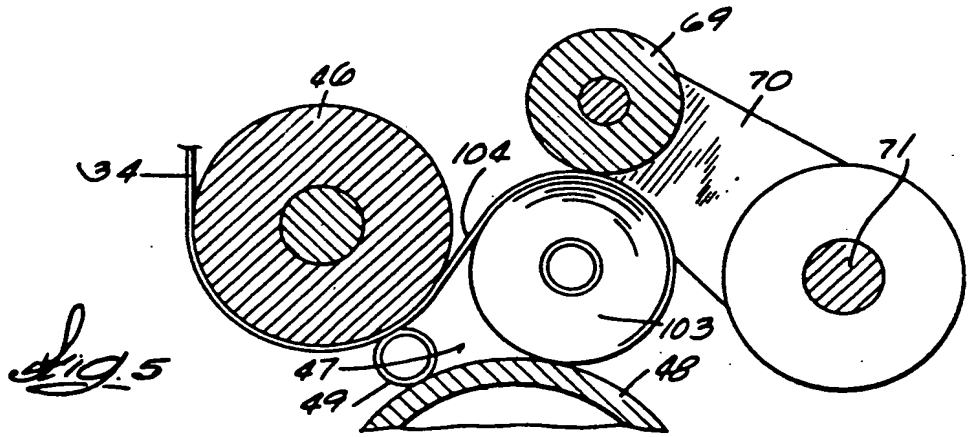

Fig. 5

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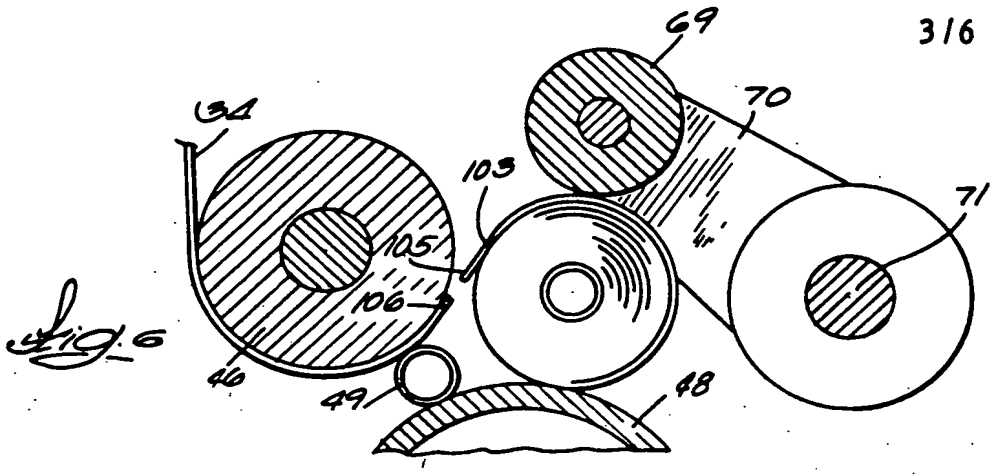

Fig. 6

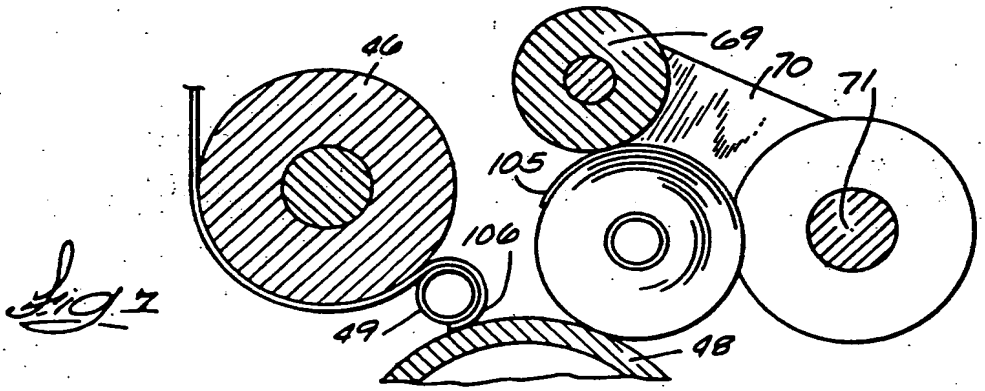

Fig. 7

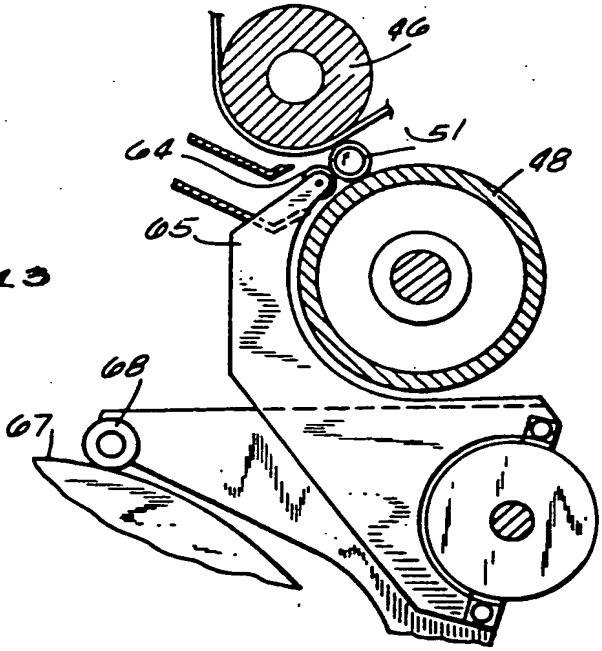

Fig. 13

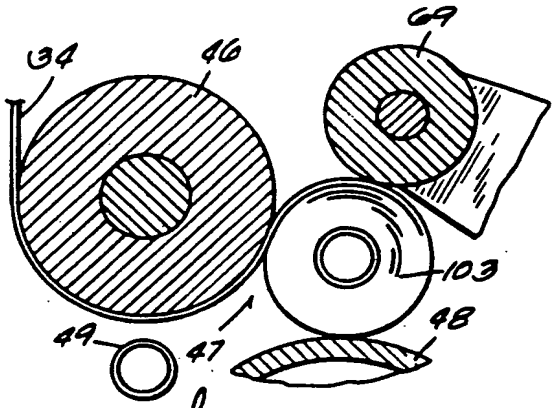

Fig. 8

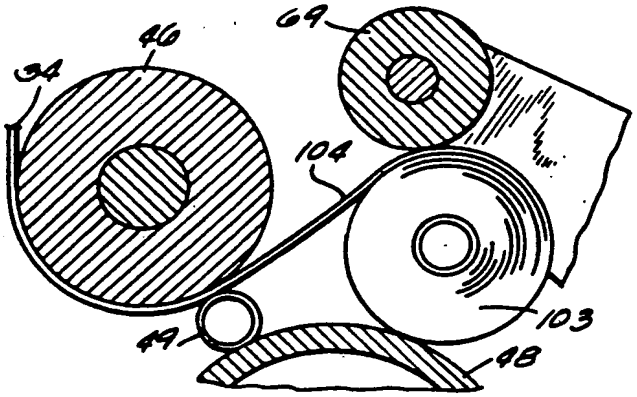

Fig. 9

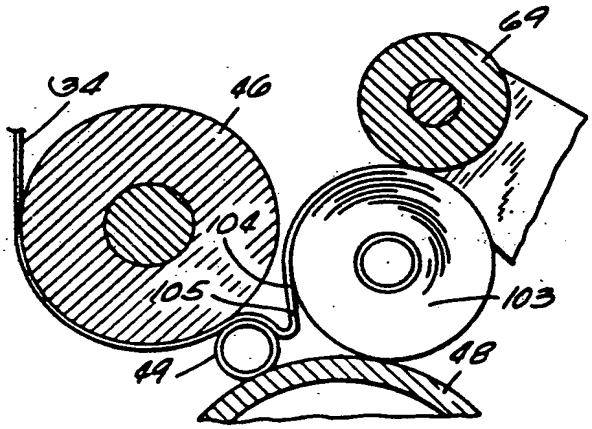

Fig. 10

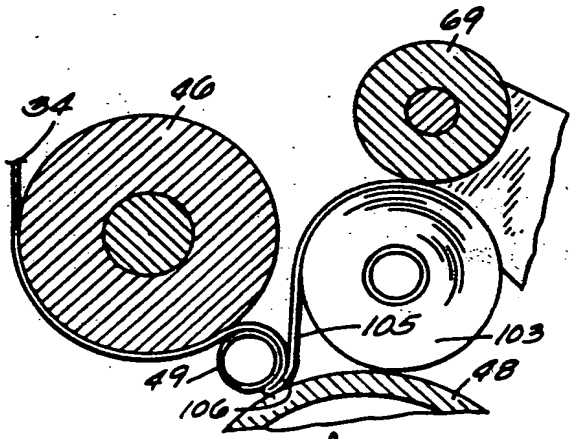

Fig. 11

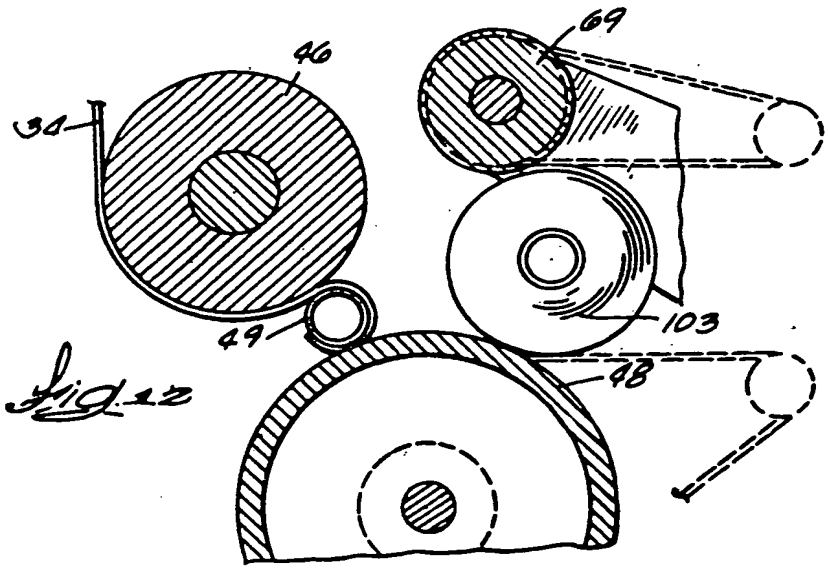

Fig. 12

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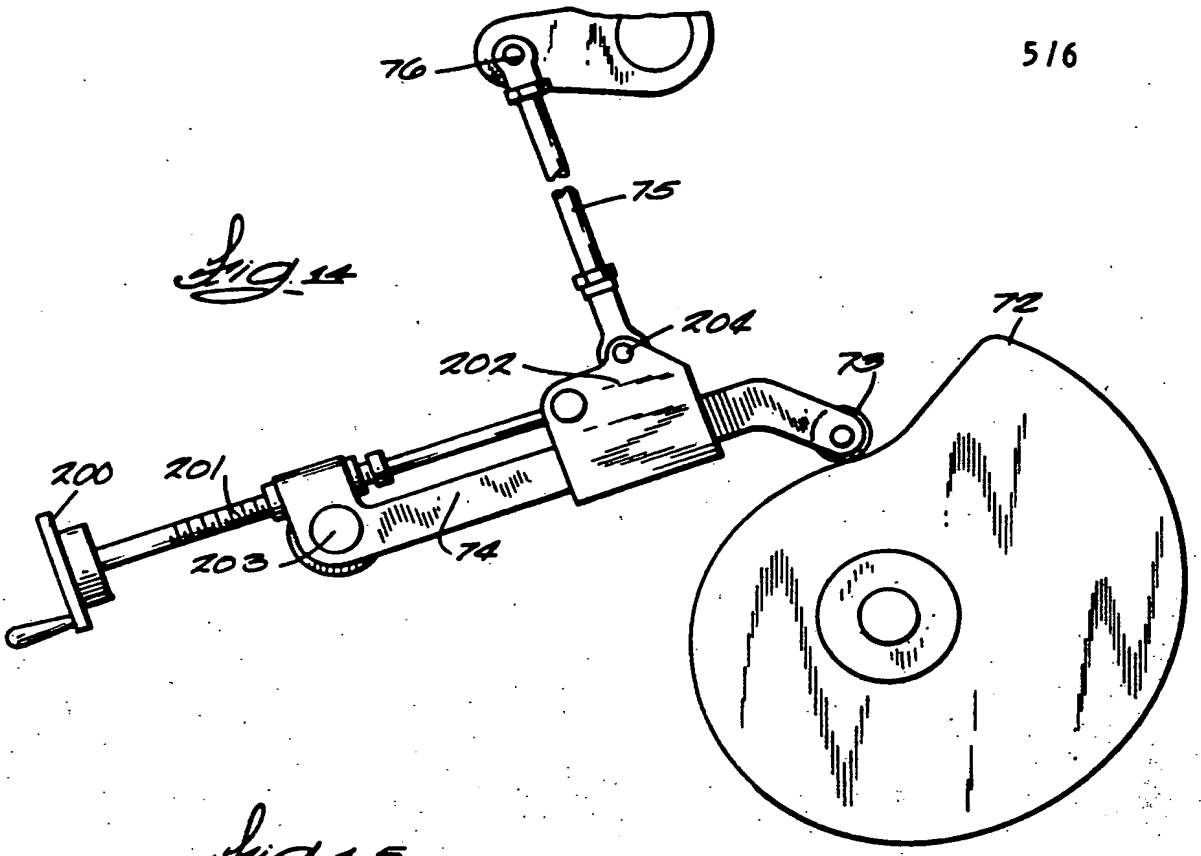
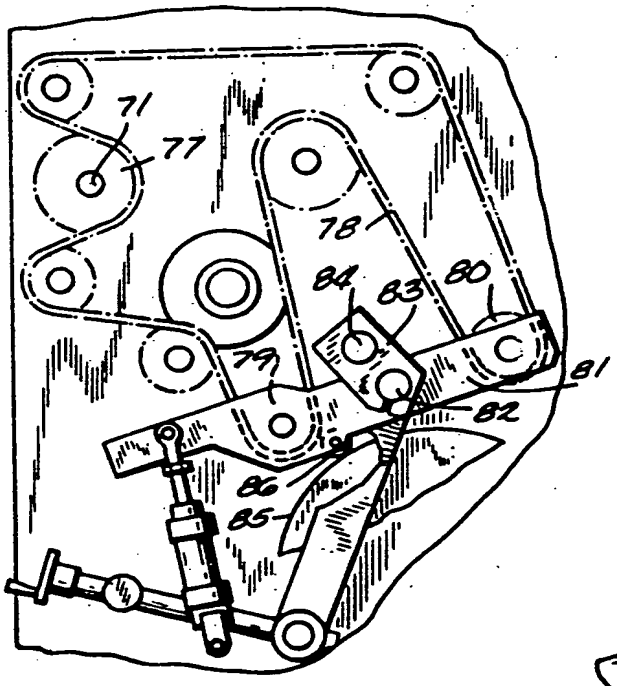


Fig. 14

Fig. 15



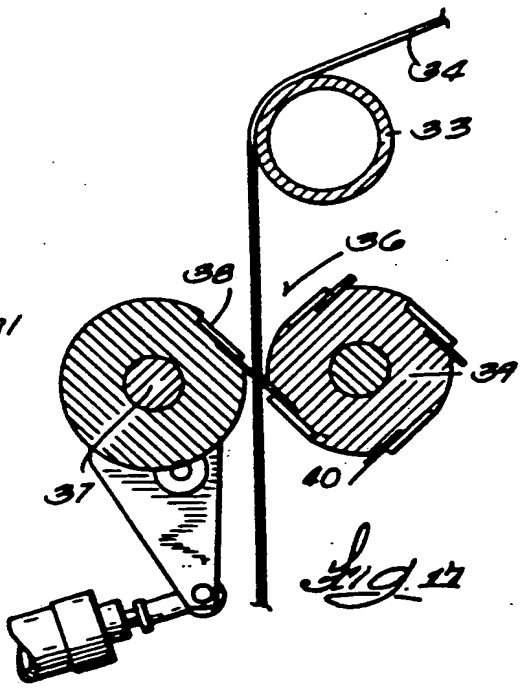


Fig. 17

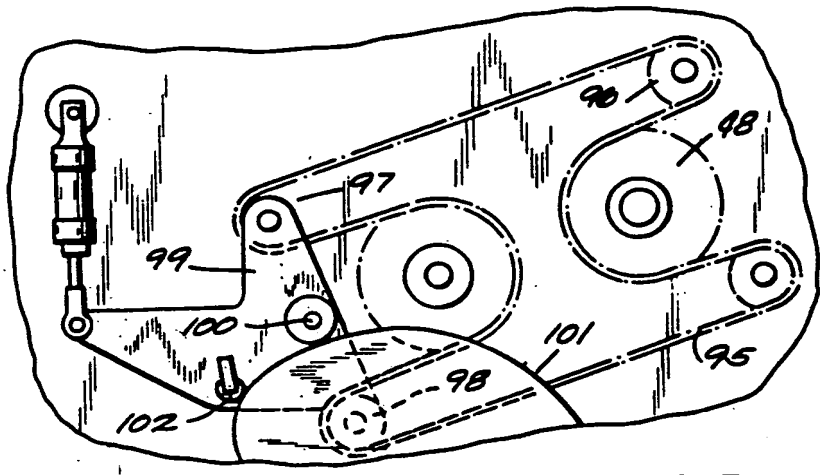


Fig. 16

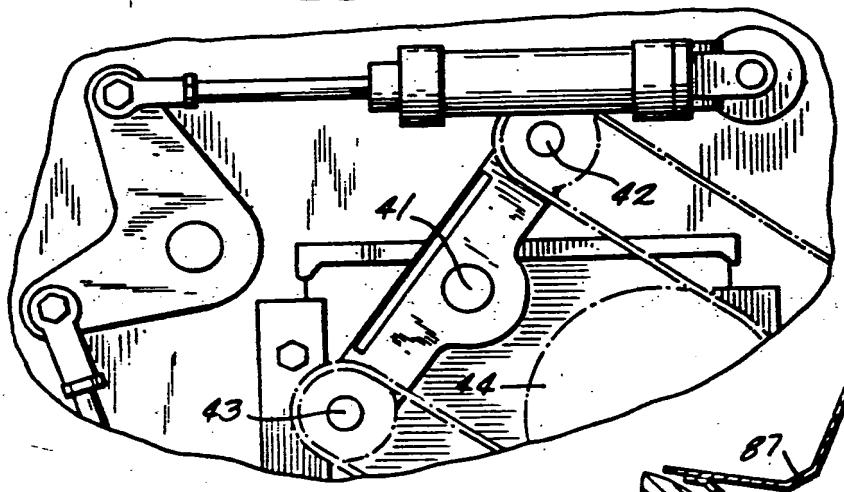


Fig. 18

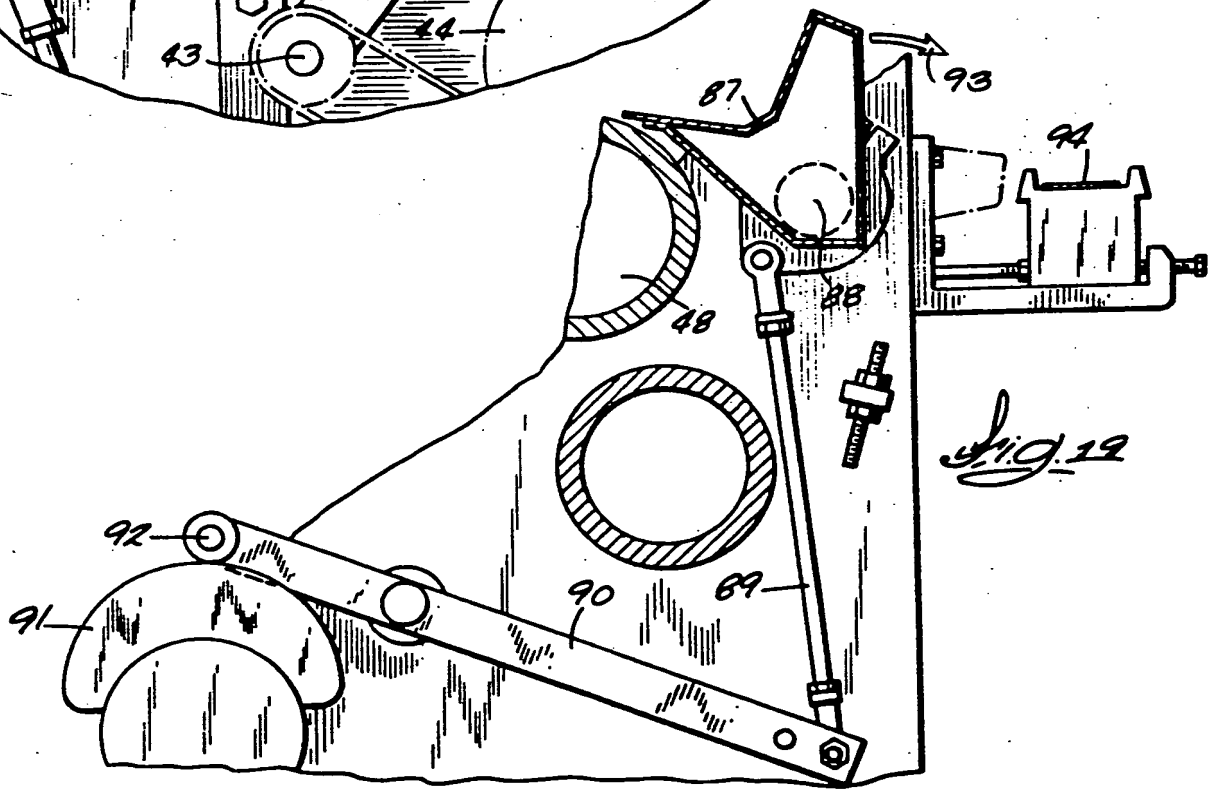


Fig. 19

mechanism 44, which is indirectly connected to the rotary blade holder 39.

This adjustment permits the blades 40 to be moved forward or backward; thus to change the location of the line of perforations in the throat 47 and thereby accurately to locate a line of perforations at the position where the snapping of the web will take place.

After the web 34 has been provided with sequential rows of perforations, the web descends from the perforating station 36 where it is brought into contact with the surface of a first winding roll 46. As is shown in Figure 1, the web 34 is carried by the surface of the roll 46 therebeneath and into the throat 47 created by surfaces of the spaced first winder roll 46 and its juxtaposed second winder roll 48. This relationship of the rolls 46 and 48 is more clearly shown in Figure 2.

The width of the throat 47 between the rolls 46 and 48 is slightly less than the outer diameter of a core 49 which is brought into the throat 47 and upon which the web 34 will be wound after the web passes beneath the roll 46.

Referring once again to Figure 1, there is shown above the frame 31 a hopper or trough 50 which is constructed and arranged to hold a pluarlity of cores or tubes 51. This storage reservoir or hopper 50 has a vertical guide slot or trough 52 radially disposed therebeneath so that a stack of cores 51 may descend therein from the hopper 50 to a glue applicator station 53.

The glue applicator station 53 may consist of a rotating member 54 which has a plurality of slots 55 (three of such slots are shown in Figure 1, disposed at 120 degrees from each other).

The slots are surrounded by a plurality of rider rolls 56 onto which the cores 51 drop when the slot is in the uppermost position, as shown in Figure 1.

When the rotary member 54 rotates in the direction of the arrow 57, a core which had been placed in the uppermost slot 55 is carried past the glue-applicator station 58 which includes a rotating glue-applicator wheel 59. As the core passes the wheel 59, the wheel 59, which is rotating in a bath of adhesive 60, carries the adhesive from the bath against the surface of the core 51, in selected positions determined by raised portions on the wheel 59, thus rotating the core against the guide members 56 and applying circular strips of glue in a plurality of locations along the length of the core 51.

Thereafter the continued rotation of the member 53 in the direction of the arrow 57 brings the core 51 to the position 61 from whence it is discharged by gravity along the chute 62 to rest at the position 63 shown in dotted lines at the lowermost portion of the chute 62.

At an appropriate moment, the core lifter mechanism (shown more specifically in Figure 13) lifts the core 51 from the position 63 and brings it into the throat 47 where, because it is slightly larger in diameter than the width of the throat, the core is pinched between the rotating first winder roll 46 and the second winder roll 48.

As will be described more fully hereinafter, at the moment the core 51 is pushed into the throat 47 by the pusher wheel 64 on the arm 65, the peripheral speed of the roll 48 has been decreased with respect to the peripheral speed of the roll 46 so that the core 51 is caused to rotate between the two rolls in the direction indicated by the arrow 66.

During this rotary action, the web 34 is pinched between the core and the first winder roll 46, adhesive is transferred from the core to the web and the web is tightly constrained between core and roll 46.

The timing of the lifter arm 65 to bring the core into the throat 47 is carefully controlled by the cam 67 and cam follower 68, and this timing is precisely maintained with respect to the speed of rotation of the other rolls in the machine and to the linear speed of the web 34.

As soon as the web 34 is wrapped around the core, the continued rotation of rolls 48 and 46 (being differentially driven so that the faster speed of the roll 46 bears against the web and core), the core is rotated out of the throat 47 into the position above the roll 48 where it continues in contact with the roll 48 and the roll 46, getting increasingly larger in diameter as shown by the dotted lines in Figure 2.

Immediately after the core passes out of the throat 47 on top of the roll 48, the rotational speed of the roll 48 is increased until its peripheral speed is the same as the roll 46 and the linear speed of the web 34 and thus the winding continues upon the core with the roll or log of paper (which is being formed on the core) maintaining contact with the surfaces of the rolls 46 and 48.

As will be seen in both Figures 1 and 2, a diameter control roll 69 is disposed above the second winder roll 48 and carried by an arm 70 which rotates about the axis 71.

This diameter control roll is arranged so as to be firmly in contact with the upper surface of the log of web material as it is wound between the rolls 46 and 48 and thus the surface speed of the diameter control roll 69 is the same as the surface speed of the rolls 46 and 48 during the winding operation. Additionally, the mechanism for controlling the elevation of the diameter control roll 69 is shown in Figure 14. In this Figure, the cam 72 bears against a cam follower 73 on an arm 74 which lifts a connecting rod 75. The upper end 76 of the shaft 75 is appropriately connected through linkages so as to rotate the arm 70 about the axis 71 under controlled restraint, and thus accurately to define and control the diameter of the log being wound on the core.

The connecting rod 75 is connected to the arm 74 by the sliding bracket 202. A pivot 204 connects the bracket 202 to the rod 75. The bracket 202 can be moved along the arm 74 by turning the handle 200 and the screw 201 and thus change the dimensions of the distances between the follower 73 and pivot 204 and between the pivot 204 and the pivot 203. This arrangement permits the adjustment of the log diameter while the machine is running and thus to change the log diameter without having to stop the machine.

Additionally, the position of the diameter control roll 69 is carefully controlled, both for acceleration and deceleration, and the mechanism for providing

SPECIFICATION

Apparatus for snap-separation of web material

The present invention relates to equipment for winding webs of sheet material such as paper, plastic, metal foil, etc., as well as to the method for winding such webs, and relates more particularly to equipment which rewinds larger rolls of paper into smaller rolls, which equipment is known in the paper industry as a high speed automatic re-winder.

This application is related to co-pending application No. 8211087 (Serial No. 2105688) which describes web perforation and other forms of web separation devices, but is directed specifically to a novel method of separating a web without cutting. It describes apparatus for snap-separating the web at a precise location to provide exact sheet-count and web-length as the web is stretched between a completed roll or log of paper and a core which is brought into contact with said web closely adjacent said completed roll.

It will be seen from the following description that the web is "snapped" between accelerating rolls and decelerating rolls and in this respect the device of the present invention differs from previous rewinders which used knives, vacuum boxes, air pressure and the like to effect the web separation.

In the apparatus and process for re-winding large parent rolls of paper onto cores for smaller consumer size rolls, one of the critical aspects of the process and apparatus is the accurate severence of the web at a predetermined sheet-count or sheet length, and the instantaneous transfer of the newly formed leading edge of the web onto a new core so that the subsequent winding of the next roll may take place. At this same instant the just-completed roll of paper must be discharged from the winding area.

The separation of the web, securing of the "tail" of the web to the completed roll, the securing of the new leading edge of the web to a new core and the removal of the finished roll from the apparatus must take place without slowing down the machine which is running at very high speed.

To accomplish this web separation and changeover there have been many previous devices proposed, not the least important of which is the Perini system illustrated in the series 800 Perini Machine, as described in Patents issued to Perini in Italy (No. 963047) and Great Britain (No. 1435525) as well as in the aforementioned co-pending British Patent application.

According to the invention there is provided apparatus for snap-separating a continuous moving web as set out in claim 1 of the claims of this specification.

An example of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a vertical cross-sectional view of the wind-up portion of an automatic re-winder.

Figure 2 is an enlarged drawing of the basic winder rolls and diameter control roll illustrating the disposition of a core as well as a completed small diameter log and a completed large diameter log.

Figures 3, 4, 5, 6 and *7* are views similar to Figure 2, illustrating the operation of the re-winder when a glue-carrying core is involved in the transfer and web separation,

Figures 8 - 12 inclusive are similar to Figure 2 and illustrate the optional form of operation of the web separation and transfer mechanism of the present invention when no adhesive is utilized.

Figure 13 illustrates a core-advancing mechanism for inserting a core into the throat between the first and second winding rolls.

Figure 14 is a schematic sectional view of the mechanism for controlling the elevtion of the diameter control roll.

Figure 15 is a fragmentary sectional view of the belt and linkage mechanism for accelerating and decelerating the diameter control roll.

Figure 16 is a schematic diagram of the belt and linkage mechanism for controlling the acceleration and deceleration of the second winding roll.

Figure 17 is a vertical cross-sectional view of the web-perforating means.

Figure 18 is a schematic diagram of the drive control mechanism for the control of the position of the web-perforating roll.

Figure 19 is a partial sectional view of the cam and link mechanism for controlling the log-discharge carrier.

Referring now to Figure 1 there is illustrated a back-stand or frame 31 which supports the rewinding equipment of the present invention.

A guide roll 32 and a turning roll 33 are supported at the upper end of the frame so as to receive a web of paper 34 travelling in the direction of the arrow 35 and to guide the web downwardly into the rewinder mechanism.

The web 34 is brought to the roll 32 from a back-stand or support which holds a large parent roll of paper and is constructed and arranged so that the parent roll may be rotated and the web 34 may unwind therefrom at the appropriate tension and speed desired.

As the web descends from the turning roll 33 it passes a perforating station 36 which is designed to apply a series of lines of perforations across the web as the web passes between a non-rotating member 37 which carries a cutter knife or blade 38, and a rotating knife-roll 39 which has a plurality of cutter knives 40 mounted thereon.

Rotation of the cutter roll 39 which brings the blades 40 into contact with the stationary perforating blade 38 is appropriately timed in relation to the linear speed of the web 34 as it descends through the perforating station so as to put an appropriate line of perforations every several inches across the web 34.

The perforation station is shown more clearly in Figure 17 and the mechanism for rotating the position of the rotatable roll 39 is shown more clearly in Figure 18.

Thus if it is desired to modify the location of a line of perforations at the throat 47, suitable drive mechanism operated by cams or otherwise may adjust the position of the shaft 41 shown in Figure 18. This causes the turning rolls 42 and 43 to pivot about the axis of the roll 41. This will turn the drive

The deceleration of the rolls 48 and 69 also cause the log 103 to move away from the throat to the position shown in Figure 9, creating the length 104 of the web 34 between the core 49 and the top of the log 103.

Thereupon the roll 69 may be decelerated, with respect to the rotary speed of the roll 48, causing the log 103 to move back towards the throat creating a loop or slack 105 in the web portion 104.

At this time the web is also beginning to wrap the core 49 and, as is shown in Figure 11, a portion of the leading edge of the web is caught between the core and the roll 48, at the position 106, creating the tension in the sheet between the nip between the core and the roll 48 and the web which is on top of the log 103.

Referring now to Figure 12, the roll 69 is once again accelerated, snapping the paper or tearing or rupturing it in the taut or tightened loop 105, separating the web which continues to wind on the new core at the throat position and causing the completed log to move away from the throat under the continued differential speed between rolls 48 and 69, with 69 moving faster than 48.

From the foregoing description, it can be seen that the differential speed control mechanism described previously provides means for selectively controlling the peripheral speed of the rolls 46; 48 and 69 as well as the linear speed of the web 34 so precisely that the log 103 may be held in a "dancing" position between the rolls 48 and 69, moving the log 103 toward the throat or away from the throat, as desired, to create the slack or loop 105 sufficiently to enable the leading edge to be pinched between the core and the roll 48 while the web is still wound on the log 103 and then subsequently accelerating the roll 69 in such a manner as to cause the web to snap along the length 105 and permit ejection of the log into the hopper 87 and thereafter the winding cycle may be repeated.

Although there have been illustrated selective means for adjusting the acceleration and deceleration of the various rolls and for controlling the position of the diameter control roll, it is to be understood that different drive mechanisms such as cone drive pulleys, P.I.V. drive and the like may be substituted, all within the scope of the invention.

In Figure 12, there are shown in dotted lines, optional auxiliary guide belts for rolls 48 and 69. These belts effectively extend the surfaceS of the respective rolls and provide surfaces on which the log 103 may be guided as it "dances" between rolls 48 and 69, thus more assuredly controlling the rotation and movement of the log as it is shifted back and forth to create the loop 105 and the snapping of the web-length 104.

This application is divided from co-pending application No. 8216620 (Serial No. 2105688) which describes and claims a method for snap-separation of web material and contains much common subject matter.

CLAIMS

1. Apparatus for winding web material on to a core to form a log of web material, comprising means for advancing a web, a first winder roll, a second winder roll, a throat formed between the spaced surfaces of the first and second winder roll, means for advancing a core to the throat, the width of said throat being less than the outer diameter of the core, a diameter control roll, means for rotating each of the first winder roll, the second winder roll, and the diameter control roll, differential speed control means for said second winder roll, which causes the second winder roll to have a peripheral speed slower than the peripheral speed of the first winder roll, causing said core to rotate and advance through said throat, differential speed control means for said diameter control roll whereby to change the peripheral speed of said diameter control roll with respect to the peripheral speed of the first winder roll, and also with respect to the peripheral speed of the second winder roll, means for guiding said web material around said first winder roll and into said throat, between said core and said first winder roll, and causing said web to wind around said core as said core rotates through said throat, a web-separation device which utilizes a temporary differential rotary speed of the driving roll mechanism, and means to modify the location of a line of perforations for the web separations.

2. Apparatus as claimed in claim 1, including means for holding said diameter control roll against the top of the web which is wound upon said core, whereby to limit and control the outer diameter of the log of web material wound upon said core.

3. Apparatus as claimed in claim 1 or claim 2, wherein the differential speed control means causes said second winder roll to have a peripheral speed slower than the peripheral speed of the diameter control roll, whereby to cause the log to move away from said throat, creating a length of web material between the throat and the log.

4. Apparatus as claimed in claim 3, including means to change the peripheral speed of the diameter control roll and the peripheral speed of the second winder roll, whereby to cause said log to return towards said throat, creating in said throat a loop of web material which is pinched between the second winder roll and a second core which has been advanced into said throat.

5. Apparatus as claimed in claim 4, wherein the differential control means for the second winder roll and the diameter control roll cause said log to move away from said throat faster than said first winder roll advances the web into the throat whereby to cause the web to separate in the area between the throat and the log of web material.

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for this deceleration and acceleration is shown in Figure 15. The axis 71 rotates under the control of a pulley 77, shown particularly in Figure 15. This pulley 77 is wrapped by a drive-belt 78 which passes around a plurality of guide pulleys, two of which (No. 79 and No. 80) are mounted on an arm 81 which pivots about an axis 82 mounted in bracket 83, which bracket itself is pivoted about the axis 84.

A cam 85 bears against a cam follower 86 mounted on the arm 81, causing the arm 81 to pivot about the axis 82, thus moving the belt 78 with respect to the axis of the roll 77.

During most of the operation of the equipment, the surface speed of the rolls 46, 48 and 69 is the same (i.e. the linear speed is the same) so as to cause the web 34 to wind up on the core to a pre-chosen position as shown in Figure 2.

When it is desired to discharge the fully wound log from the position shown in Figure 2, the surface speed of the diameter control roll 69 and the second winding roll 48 may be modified so that the peripheral speed of the roll 69 is greater than that of the roll 48 whereupon the log is ejected from the position shown in Figure 2 to pass into a log receiving hopper 87 shown in Figure 19.

When the log of wound paper is discharged into the hopper 87, the hopper is subsequently rotated about the axis 88 by the arm 89 whic is moved under the influence of the lever 90 pushed by the cam 91 against the cam follower 92. This rotates the hopper 87 in the direction of the arrow 93 depositing the log upon the log-carrying conveyor 94. After that the hopper returns to the position shown in Figure 19 ready to receive the next log of web material.

The mechanism for accelerating and decelerating the second winder roll 48 is shown in Figure 16 wherein a belt 95 wraps around a portion of the roll 48 and a plurality of guide rolls 96, two of which 97 and 98 are carried by the arm 99 which pivots about the axis 100 under the influence of the cam 101 bearing it against a cam follower 102 secured to the arm 99.

When desired, the cam 101 is rotated, causing the arm 99 to pivot about the axis 100 thus changing the position of the rollers 97 and 98 and causing relative movement in the roll 48 so as to either increase or decrease the speed of rotation of the roll 48 as is desired.

From the foregoing it can be seen that the relative speeds of rolls 46, 48 and 69 can be nicely and carefully controlled with respect to the linear speed of the web 34 as it passes through the rewinding mechanism. As it has been stated earlier, under most circumstances, the linear web speed and the peripheral speed of the rolls 46, 48 and 69 is the same. However, when it is desired to introduce a core into the throat 47, the roll 48 may be decelerated with respect to the roll 46.

At the same time the deceleration of roll 48 with respect to the rotary speed of the roll 69 causes the log to move out of the finished position as shown in Figure 2 in a manner to create a strip or length 104 of the web material 34 between the position where the core and roll 46 pinch the web between each other and the upper surface of the finished roll. This tensioning and web creating situation is shown more clearly in Figures 3 - 7 inclusive and Figures 8 - 12 inclusive which will now be described.

In Figure 3 the glue-carrying core 49 is brought into position a small distance in advance of the throat 47 while the rolls 46, 48 and 69 are operating at the same peripheral speed.

The log 103 is just finishing its winding operation under the influence of the three rolls. As the core-pusher 65 moves the core 49 further into the throat 47, the web 34 is pinched between the core and the roll 46 and at the same moment the roll 48 is decelerated causing the core to roll forwardly into the throat along with the web 34.

At this moment the log 103 also begins to move out of the winding position because of the deceleration of the roll 48 to a position shown in Figure 5. At this position a length 104 of the web 34 is created between the log 103 and the core 49.

At the same instant, the roll 69 is decelerated to bring it into the same peripheral speed as the roll 48 so that the log 103 remains in position between the rolls 48 and 69.

Referring now to Figure 6, the rotary speed of the roll 69 is increased with respect to the roll 48 causing the log 103 to move still farther away from the throat and thus, as is shown in Figure 7, snapping or tearing the web 34 along the length 104.

As the core 49 was introduced into the throat 47, the peripheral strips of adhesive on the core were transferred to the web 34 along a portion of the web which creates the web portion 104. After the web is separated along the portion 104, some of the adhesive is retained on the "tail" 105 and some is retained on the leading edge 106 of the web, thus the adhesive can be utilized to "tie" the tail 105 to the log and also to adhere the leading edge 106 to the core 49.

Continued rotation of the roll 69 at a speed faster than the roll 48 ejects the log into the log-receiving hopper 87 while at the same time the slower rotary speed of the roll 48 with respect to roll 46 moves the core and web out of the throat into the winding position with the web securely held to the core by the adhesive material.

Whereupon the cycle is repeated until the new log is wound to the appropriate diameter and web length whereupon the separation and transfer cycle is repeated.

It must be stated at this point that the transfer procedure and mechanism shown in Figures 3 - 7 inclusive may be used with or without adhesive and the choice of using or not using the adhesive may be dependent upon several factors, including the type of web material and the speed of operation.

Referring now to Figures 8 - 12 inclusive, there is shown a procedure similar to that shown in Figures 3 - 7 inclusive.

In Figure 8 the rolls 48, 46 and 69 are rotating at the same peripheral speed until the log 103 is wound to the proper diameter and the core 49 is introduced to the entrance to the throat 47.

In Figure 9, the roll 48 is decelerated, causing the core 49 to enter the throat and come into contact with the web 34.

[redacted]

Ufficio Italiano Brevetti e Marchi

[redacted]

Ministero delle Attività Produttive
Direzione Generale Sviluppo Produttivo e Competitività
Roma, via Molise 19
Base dati aggiornata a giovedì 23 febbraio 2006

Numero domanda:	**MI1995A001174**	**Data deposito:**	**06/06/1995**
Numero brevetto:	**0001275313**	**Data registrazione:**	**05/08/1997**
Titolo:	metodo e macchina per la produzione di rotoli o logs di materiali in foglio		
Anticipata accessibilità:	NO		
Stato Domanda:	rilasciata		

Titolare:	ALBERTO CONSANI S.P.A. (LU)
Nome studio:	RACHELI & C. S.P.A.
Indirizzo:	VIALE S. MICHELE DEL CARSO 4 - 20144 MILANO (MI)

Inventore: MATTEUCCI RENATO

Codice classe:
B65H

Priorità: -

Centro raccolta colture microorganismi: -

veg/1991 provv.

AL MINISTERO DELL'INDUSTRIA DEL COMMERCIO E DELL'ARTIGIANATO — MODULO
UFFICIO ITALIANO BREVETTI E MARCHI - ROMA
DOMANDA DI BREVETTO PER INVENZIONI INDUSTRIALE, DEPOSITO RISERVE, ANTICIPATA ACCESSIBILITÀ AL PUBBLICO

A. RICHIEDENTE (I) N.G.

1) Denominazione | ALBERTO CONSANI S.p.A. | SP
Residenza | Diecimo, Borgo a Mozzano (Lucca) | codice 00279110464

2) Denominazione |
Residenza | codice

B. RAPPRESENTANTE DEL RICHIEDENTE PRESSO L'U.I.B.M.

cognome nome | Dr. Ing. Petruzziello Aldo ed altri | cod. fiscale
denominazione studio di appartenenza | DR. ING. A. RACHELI & C. S.r.l.
via | le San Michele del Carso | n. 0004 | città | Milano | cap 20144 | (prov)

C. DOMICILIO ELETTIVO destinatario | vedi sopra
via | n. | città | cap | (prov)

D. TITOLO classe proposta (sez/cl/scl) | gruppo/sottogruppo |

"METODO E MACCHINA PER LA PRODUZIONE DI ROTOLI O LOGS DI MATERIALI IN FOGLIO"

ANTICIPATA ACCESSIBILITÀ AL PUBBLICO: SI [ ] NO [X] — SE ISTANZA: DATA / / — N° PROTOCOLLO

E. INVENTORI DESIGNATI (cognome nome)

1) Matteucci Renato
2)
3)
4)

F. PRIORITÀ

	nazione o organizzazione	tipo di priorità	numero di domanda	data di deposito	sciogliento S/R	SCIOGLIMENTO RISERVE Data	SCIOGLIMENTO RISERVE N° Protocollo
1)	NESSUNA			/ /		/ /	
2)				/ /		/ /	

G. CENTRO ABILITATO DI RACCOLTA COLTURE DI MICRORGANISMI, denominazione |

H. ANNOTAZIONI SPECIALI

NESSUNA

DOCUMENTAZIONE ALLEGATA

	N. es.				SCIOGLIMENTO RISERVE Data	SCIOGLIMENTO RISERVE N° Protocollo
Doc. 1)	1	PROV	n. pag 10	riassunto con disegno principale, descrizione e rivendicazioni (obbligatorio 1 esemplare)	/ /	
Doc. 2)	1	PROV	n. tav 03	disegno (obbligatorio se citato in descrizione, 1 esemplare	/ /	
Doc. 3)	1	RIS		lettera d'incarico, procura o riferimento procura generale	/ /	
Doc. 4)	0	RIS		designazione inventore	/ /	
Doc. 5)	0	RIS		documenti di priorità con traduzione in italiano	confronta singole priorità	
Doc. 6)	0	RIS		autorizzazione o atto di cessione	/ /	
Doc. 7)	0			nominativo completo del richiedente		

8) 1 attestati di versamento totale lire | TRECENTOSESSANTACINQUEMILA======== | obbligatorio

COMPILATO IL 06/06/1995 — **FIRMA DEL(I) RICHIEDENTE (I)** | DR. ING. A. RACHELI & C. S.r.l.
CONTINUA SI/NO NO | (Dr. Ing. Aldo Petruzziello)
DEL PRESENTE ATTO SI RICHIEDE COPIA AUTENTICA SI/NO SI

UFFICIO PROVINCIALE IND. COMM. ART. DI | Milano | codice 15
VERBALE DI DEPOSITO — **NUMERO DI DOMANDA** MI 95/A 001174 | Reg.A
L'anno millenovecento | novantacinque | il giorno | sei | del mese di | giugno
il(i) richiedente(i) sopraindicato(i) ha(hanno) presentato a me sottoscritto la presente domanda, corredata di n 00 fogli aggiuntivi per la concessione del brevetto sopraripportato.

I. ANNOTAZIONI VARIE DELL'UFFICIALE ROGANTE |

IL DEPOSITANTE — timbro — L'UFFICIALE ROGANTE

veg/1991 provv.

PROSPETTO A

RIASSUNTO INVENZIONE CON DISEGNO PRINCIPALE, DESCRIZIONE E RIVENDICAZIONE

NUMERO DOMANDA MI 95/A 001174 REG. A DATA DI DEPOSITO 06/06/1995

NUMERO BREVETTO ... DATA DI RILASCIO .../.../...

D. TITOLO

"METODO E MACCHINA PER LA PRODUZIONE DI ROTOLI O LOGS DI MATERIALI IN FOGLIO"

L. RIASSUNTO

Vengono descritti un metodo e una macchina per la produzione di rotoli o logs di materiali in foglio, quale carta e simili, in cui il nastro di carta (W) viene rinviato intorno ad un primo rullo avvolgitore (A) per essere avvolto intorno ad un'anima tubolare (2), posta in rotazione tra detto rullo (A) e un'altra coppia di rulli (B, C), il rullo (C) essendo montato mobile per consentire l'aumento di diametro del rotolo (1) e lo scarico dello stesso a termine avvolgimento, mentre i rulli (A) e (B) determinano una gola (3) attraverso la quale viene trasferita l'anima (2) nello spazio di avvolgimento, a monte di detta gola (3) essendo previsto un dispositivo (6) atto a pinzare la carta (W) contro detto rullo (A) per provocare lo strappo della stessa, e atto altresì a trasferire una nuova anima (2) attraverso detta gola (3).

M. DISEGNO

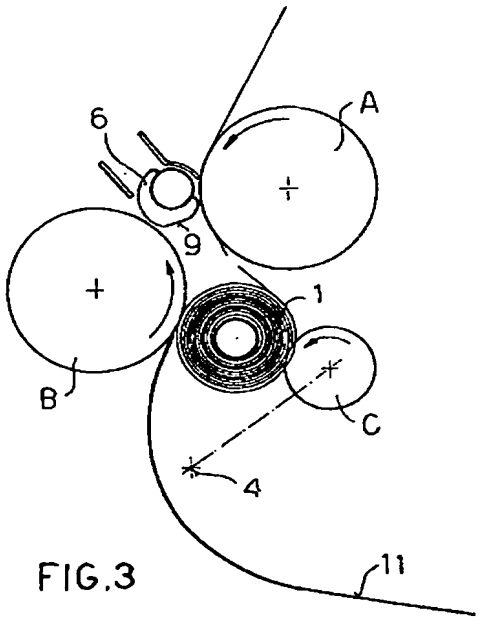

FIG.3

Descrizione dell'invenzione avente per titolo:

"METODO E MACCHINA PER LA PRODUZIONE DI ROTOLI O LOGS DI MATERIALI IN FOGLIO"

MI 95 A 001174

Della Ditta: ALBERTO CONSANI S.p.A.

di nazionalità italiana, con sede a Diecimo, Borgo a Mozzano (Lucca) - che nomina quali mandatari e domiciliatari, anche in via disgiunta fra loro, Dr. Diana Domenighetti, Avv. Vincenzo Bilardo, Dr. Ing. Aldo Petruzziello, Dr. Maria Teresa Marinello e Dr. Ing. Maria Chiara Zavattoni, dell'Ufficio DR. ING. A. RACHELI & C. s.r.l. - Milano - Viale San Michele del Carso, 4.

Inventore: Matteucci Renato

Depositata il: N.: 6 GIU. 1995

DESCRIZIONE

La presente invenzione ha per oggetto un metodo e una macchina ribobinatrice per la produzione di rotoli o logs di materiali in foglio, quali carta e simili, su un supporto tubolare.

La macchina ribobinatrice secondo l'invenzione è del tipo cosiddetto ad avvolgimento periferico, cioè in cui il rotolo viene avvolto intorno ad un'anima tubolare che viene posta in rotazione tra una terna di rulli che agiscono sulla periferia del rotolo in formazione, e le cui velocità vengono tenute costanti durante il ciclo di avvolgimento.

La terna di rulli motorizzati forma uno spazio di dimensioni variabili, in modo che i tre rulli siano sempre a contatto con il rotolo in formazione, mano a mano che questo aumenta di diametro. Due dei tre rulli sono posti ad una distanza fissa o variabile, in modo da definire una gola, attraverso la quale viene inserita l'anima, e in cui transita il materiale in foglio, mentre il terzo rullo o pressina è

mobile per consentire l'aumento di diametro del rotolo e l'espulsione dello stesso al termine dell'avvolgimento.

In queste macchine ribobinatrici importante è la fase cosiddetta di scambio, cioè l'inserimento di una nuova anima nello spazio di avvolgimento, accompagnata da un apposito introduttore, e lo scarico del log completato, a seguito della rottura del materiale nastriforme.

Ciò viene ottenuto in svariati modi secondo la tecnica nota, che richiedono generalmente delle repentine variazioni di velocità di due dei tre rulli avvolgitori.

Secondo alcuni metodi noti, la variazione di velocità di tali rulli provoca il tensionamento e lo strappo del nastro di carta a seguito della pinzatura dello stesso contro il rullo sul quale viene rinviato, pinzatura che può avvenire mediante la nuova anima o un mezzo ausiliario che viene spinto contro tale rullo. Ulteriori mezzi sono previsti per alimentare la nuova anima alla gola tra i due rulli di entrata.

Nel caso che il nastro venga pinzato con un mezzo diverso dall'anima, viene previsto un preavvolgimento del rotolo tra il rullo avvolgitore intorno al quale viene rinviato il nastro e una controsuperficie concava di contrasto sulla quale il log viene fatto rotolare nella fase iniziale di avvolgimento, per essere poi introdotto nello spazio di avvolgimento vero e proprio costituita dalla terna di rulli motorizzati.

Tutto ciò comporta una notevole complessità costruttiva della macchina.

Scopo dell'invenzione è quello di fornire un metodo e una macchina ribobinatrice che semplifichi notevolmente la fase di strappo del materiale in foglio e di scambio, senza richiedere mezzi aggiuntivi per l'introduzione dell'anima nello spazio di avvolgimento, o per il preavvolgimento del nastro sull'anima.

Un altro scopo dell'invenzione è quello di avere una lunghezza precisa e costante del materiale in foglio avvolto in ciascun rotolo.

L'invenzione presenta le caratteristiche elencate nelle annesse rivendicazioni indipendenti.

Ulteriori caratteristiche dell'invenzione emergono dalle rivendicazioni dipendenti.

In particolare, a monte della gola di introduzione dell'anima è previsto un dispositivo a culla, alloggiante un'anima tubolare, atto ad andare ciclicamente a contatto con il rullo sul quale è rinviato il materiale nastriforme, al termine di ogni ciclo di avvolgimento, e atto allo stesso tempo ad accompagnare la nuova anima nello spazio di avvolgimento.

Il dispositivo di pinzatura della carta e di introduzione della nuova anima ha in particolare la forma di una mezzaluna ed effettua un movimento rotatorio alternato, distanziandosi, in momenti prestabiliti, dal rullo avvolgitore sul quale è rinviata la carta. Convenientemente, tale distanziamento viene ottenuto legando il movimento del dispositivo a "mezzaluna" a quello del secondo rullo avvolgitore che forma la gola di introduzione dell'anima, e che, convenientemente, è montato mobile rispetto al primo rullo sul quale viene rinviata la carta, in modo da variare la distanza da questo.

Ulteriori caratteristiche dell'invenzione risulteranno più chiare dalla descrizione dettagliata che segue, riferita ad una sua forma puramente esemplificativa, e quindi non limitativa di realizzazione, illustrata nei disegni annessi, in cui:

le figure da 1 a 9 sono viste laterali schematiche illustranti fasi successive del ciclo di avvolgimento.

Nelle figure annesse, con W è indicato un materiale nastriforme, in particolare carta, che viene svolto da una bobina di grosse dimensioni, non mostrata, e, avanzando nel senso della freccia F, viene rinviato intorno ad un primo rullo avvolgitore A, per essere riavvolto in rotoli o logs 1, di diametro notevolmente più piccolo, intorno ad un'anima centrale 2.

Al primo rullo avvolgitore A è associato un secondo rullo avvolgitore B, che determina con esso una gola 3, attraverso la quale vengono inserite le anime 2. La terna di rulli avvolgitori è completata da un terzo rullo C, detto anche pressina, mobile intorno ad un fulcro 4, con una legge di moto prestabilita, per consentire l'aumento di diametro del rotolo 1 e lo scarico dello stesso a termine avvolgimento.

Convenientemente, il secondo rullo avvolgitore B è montato in modo che la sua distanza dal primo rullo avvolgitore A possa essere variata per consentire un più agevole inserimento dell'anima in avvolgimento attraverso la gola 3, come descritto ad esempio nel brevetto europeo n. 89911386.4 della stessa Consani S.p.A..

A monte della gola 3 è previsto un canale 5 di alimentazione delle anime 2, che termina in un dispositivo a culla o a "mezzaluna" 6, atto ad alloggiare un'anima 2. Il dispositivo 6 può estendersi per tutta la larghezza della macchina, o essere composto da settori montati su di una barra di torsione.

Il dispositivo 6 può essere comandato da un attuatore indipendente o da un comando meccanico controllato dalla trasmissione principale della macchina.

Convenientemente, il dispositivo 6 è montato sui bracci di supporto del rullo B, in modo da seguire i movimenti di questo e allontanarsi dal rullo A quando deve ritornare in posizione, come si vedrà meglio in seguito.

Verrà ora illustrato il funzionamento della macchina facendo riferimento

alla successione di fasi illustrate nelle figure da 1 a 9.

La figura 1 illustra la configurazione della macchina in prossimità dello scambio, cioè all'incirca al termine dell'avvolgimento del rotolo 1, quando questo sta per essere scaricato e deve essere introdotta una nuova anima 2. In tale condizione il rullo B si è avvicinato al rullo A, portandosi alla minima distanza da questo, e disponendo quindi il dispositivo a culla 6 nella corretta posizione per poter pinzare la carta W contro il rullo A a seguito di una rotazione. In particolare, il dispositivo 6, oltre ad una sede interna 7 per l'alloggiamento di un'anima 2, presenta un profilo esterno curvo 8 con un tratto smussato 9, che in figura 1 si contrappone alla superficie esterna del rullo A, consentendo il libero passaggio della carta W.

I tre rulli A, B, C ruotano tutti a velocità costanti e uguali tra loro, ad eccezione del rullo B, la cui velocità è leggermente inferiore a quella del rullo A, ad esempio l'1% più bassa.

In figura 2 il rullo C è accelerato rispetto agli altri rulli, per facilitare l'espulsione del rotolo 1 e il tensionamento del tratto di carta W tra tale rotolo e il rullo A. Allo stesso tempo, viene posto in rotazione il dispositivo 6, che con il suo tratto terminale 10, fungente da camma, va a contatto con la carta premendola contro il rullo A. La velocità con cui il dispositivo a culla 6 va a contatto con il primo rullo avvolgitore A è inferiore a quella di quest'ultimo, provocando così la pinzatura della carta e lo strappo della stessa, come mostrato in figura 3, dove il dispositivo 6 è ruotato ulteriormente e aumenta la propria velocità di rotazione, fino a che questa diventa uguale alla velocità di avanzamento della carta W. In tal modo, la nuova anima 2, accompagnata dal dispositivo 6 va a contatto della carta W alla stessa velocità di quest'ultima, e può riprenderla facilmente, grazie alla

presenza di adesivo preventivamente applicato sull'anima (figura 4).

La figura 4 mostra anche la fase di espulsione del log completato 1, che viene avviato verso uno scivolo di scarico 11.

In figura 5 il dispositivo a culla 6 subisce una brusca frenata, in modo che il rullo A provochi la fuoriuscita dell'anima dalla sede 7 della culla 6, come mostrato in figura 6.

La figura 7 mostra l'istante in cui si ha il contatto tra l'anima e i due rulli A, B. Nel frattempo, ovviamente, il rullo C è risalito per accogliere il rotolo in arrivo e si è riportato alla velocità costante di avvolgimento.

La figura 8 mostra l'inizio dell'avvolgimento del rotolo tra i due rulli A e B, e il rullo B inizia a distanziarsi dal rullo A per evitare un avvolgimento troppo stretto.

La figura 9 mostra la traslazione del rotolo nella gola tra i due rulli A e B, facilitata anche dalla differenza di velocità esistente tra tali rulli.

Il dispositivo 7 intanto viene fatto ruotare in senso contrario al precedente, senza rischio di andare a contatto con il rullo A, grazie alla maggiore distanza esistente tra i rulli A e B.

Il rullo B verrà poi riavvicinato al rullo A, in modo che il dispositivo a culla 6 si disponga nella posizione mostrata in figura 1, cioè con il suo tratto smussato 9 contrapposto alla superficie esterna del rullo A, ed è pronto a ricevere una nuova anima 2 dal canale caricatore 5.

Sia il primo rullo avvolgitore A che il dispositivo a culla o a mezzaluna 6 possono essere provvisti di mezzi di aspirazione interna, per la creazione del vuoto, rispettivamente per tenere il lembo iniziale dopo lo strappo ed evitare movimenti indesiderati dell'anima 2.

RIVENDICAZIONI

1. Metodo per la produzione di rotoli o logs (1) di materiali in foglio, quali carta e simile, in cui il materiale in foglio (W) viene rinviato intorno ad un primo rullo avvolgitore (A) e avvolto intorno ad un'anima tubolare (2), posta in rotazione tra detto rullo (A) e due altri rulli (B, C), e in cui detto nastro (W) viene strappato al termine dell'avvolgimento di un rotolo (1), caratterizzato dal fatto che detto strappo avviene pinzando la carta (W) contro il rullo (A) mediante un dispositivo (6) atto anche ad introdurre una nuova anima (2) nello spazio di avvolgimento.

2. Metodo secondo la rivendicazione 1, caratterizzato dal fatto che durante detta fase di strappo è prevista l'accelerazione di detto rullo (C), che è montato mobile per seguire l'aumento di diametro del rotolo (1).

3. Metodo secondo la rivendicazione 1 o 2, caratterizzato dal fatto di prevedere una rotazione di detto dispositivo (6) a velocità inferiore a quella della carta (W) per effettuare la pinzatura di quest'ultima, e una successiva accelerazione fino alla stessa velocità della carta (W), per portare la nuova anima (2) a contatto con la carta alla stessa sua velocità.

4. Metodo secondo la rivendicazione 3, caratterizzato dal fatto di prevedere altresì una brusca fumata del dispositivo (6), per provocare la fuoriuscita dell'anima (2) per azione della rotazione del rullo (A).

5. Metodo secondo la rivendicazione 3 o 4, caratterizzato dal fatto che il movimento di ritorno di detto dispositivo (6) avviene in senso contrario al precedente, con il dispositivo (6) tenuto maggiormente distanziato dal rullo (A) almeno nel tratto finale del moto, per evitare il contatto con tale rullo.

6. Metodo secondo una qualsiasi delle rivendicazioni precedenti, caratterizzato dal fatto di prevedere un montaggio mobile di detto rullo (B) rispetto

a detto rullo (A), e una legge di moto di detto dispositivo (6) dipendente da quella del rullo (B).

7. Macchina per la produzione di rotoli o logs (1) di materiale in foglio (W) intorno ad un'anima centrale tubolare (2), comprendente un primo rullo avvolgitore (A) intorno al quale viene rinviato il materiale in foglio (W), un secondo rullo avvolgitore (B) formante una gola (3) con il primo rullo (A), attraverso la quale viene fatta transitare l'anima (2), e un terzo rullo (C) montato mobile per consentire l'aumento di diametro del rotolo (1) e lo scarico dello stesso a termine avvolgimento, caratterizzata dal fatto che a monte di detta gola (3) è previsto un dispositivo (6) atto a pinzare la carta (W) contro detto primo rullo (A) per provocarne lo strappo al termine del ciclo di avvolgimento, e atto altresì a trasferire una nuova anima (2) in detta gola (3).

8. Macchina secondo la rivendicazione 7, caratterizzata dal fatto che detto dispositivo (6) è un dispositivo a culla o a mezzaluna recante una sede (7) per l'alloggiamento di un'anima (2) e un profilo esterno curvo (8) con una smussatura (9) atta a posizionarsi frontalmente alla superficie esterna di detto rullo (A) in condizioni di riposo, cioè durante il ciclo di avvolgimento del rotolo (1) in modo che una rotazione di detto dispositivo (7) porti un suo tratto terminale (10) a contatto con il rullo (A) sul quale è rinviato il materiale in foglio (W).

9. Macchina secondo la rivendicazione 7 o 8, caratterizzata dal fatto che detto dispositivo (6) è montato in modo da poter ruotare e da potersi distanziare da detto rullo (A).

10. Macchina secondo una qualsiasi delle rivendicazioni da 6 a 9, caratterizzata dal fatto che detto rullo (B) è montato mobile rispetto a detto rullo (A) e detto dispositivo (6) è montato sui bracci di supporto di detto rullo (B).

11. Macchina secondo una qualsiasi delle rivendicazioni da 7 a 10, caratterizzata dal fatto di prevedere mezzi per far ruotare a velocità differenziata detto dispositivo (6).

12. Macchina secondo una qualsiasi delle rivendicazioni da 7 a 11, caratterizzata dal fatto di prevedere mezzi per accelerare temporaneamente detto rullo (C) durante la fase di scambio.

13. Macchina secondo una qualsiasi delle rivendicazioni da 7 a 12, caratterizzata dal fatto di prevedere mezzi a vuoto su detto primo rullo (A) e/o su detto dispositivo a culla (6).

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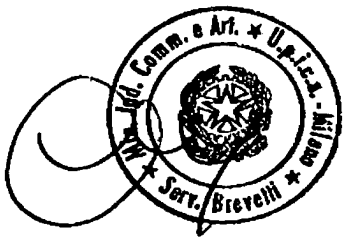

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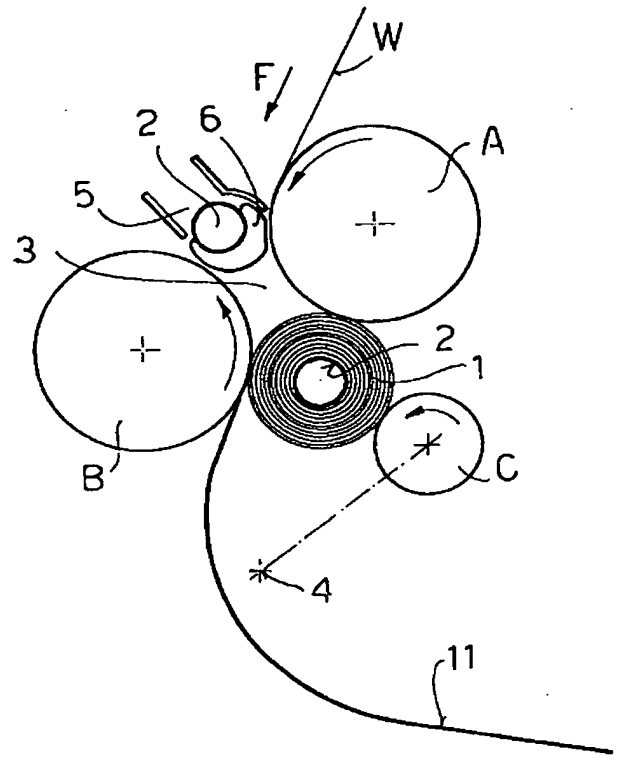

FIG. 1

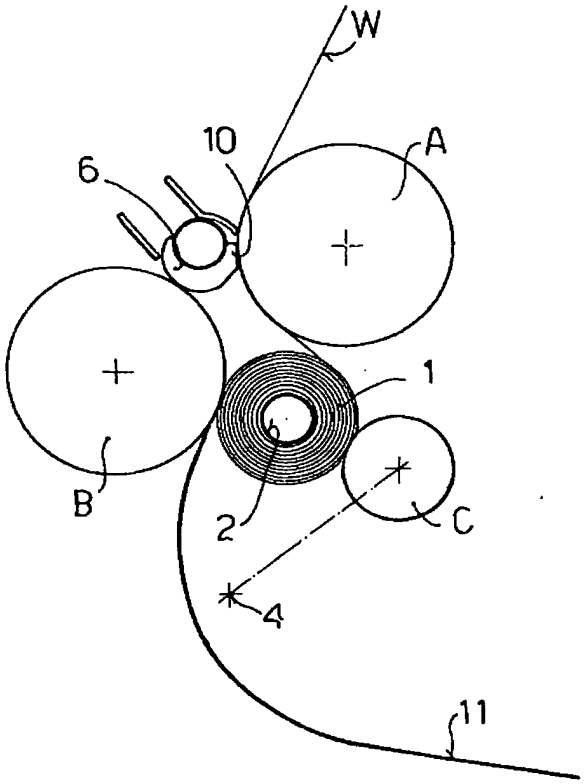

FIG. 2

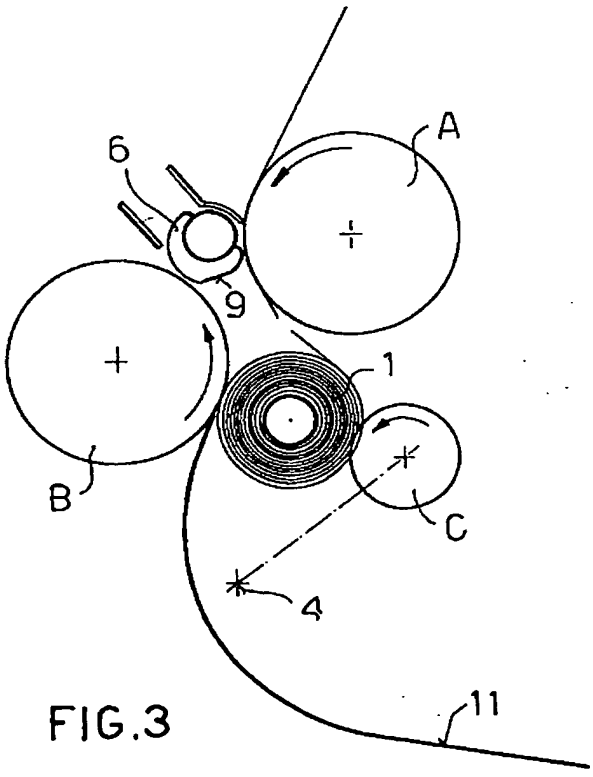

FIG. 3

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24526BE/95

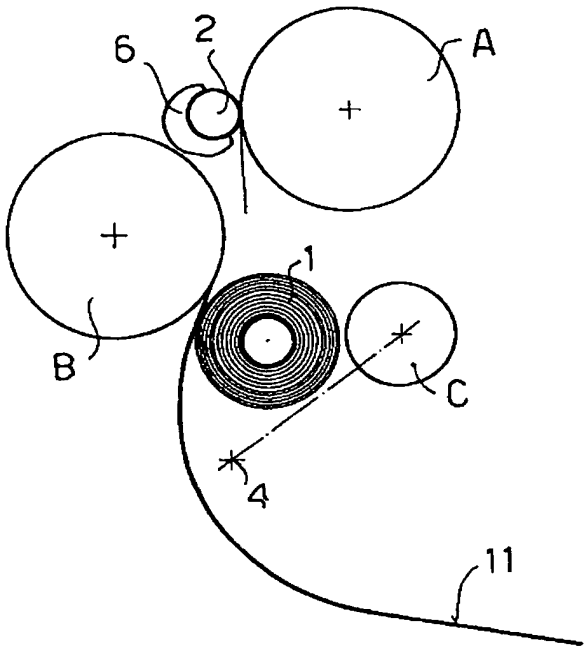


FIG. 4

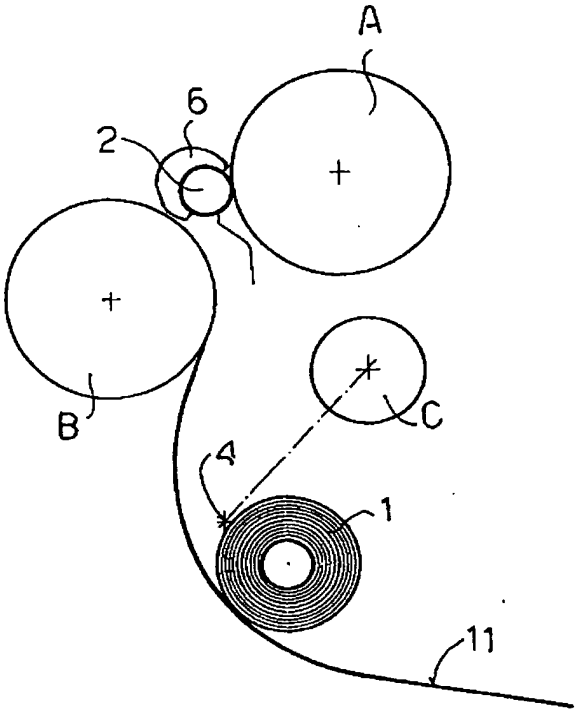


FIG. 5

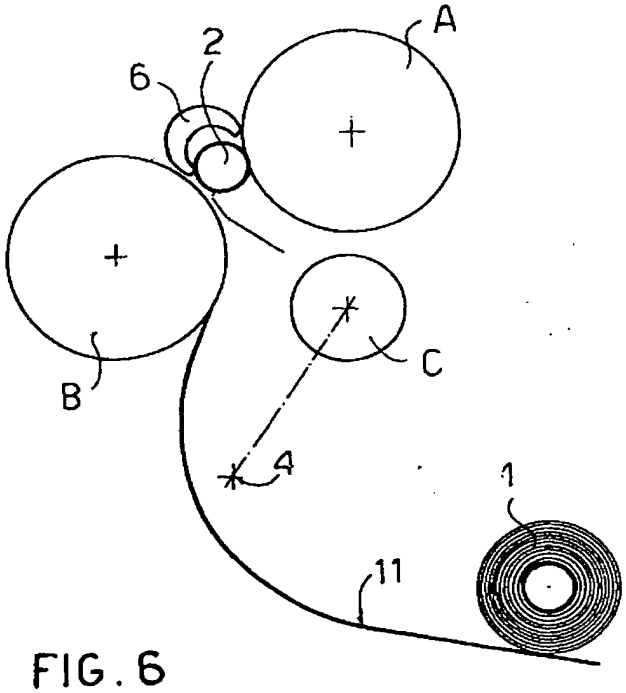
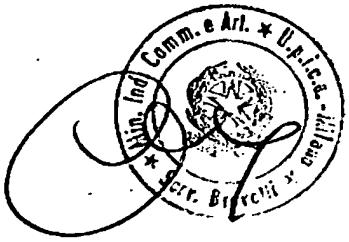


FIG. 6



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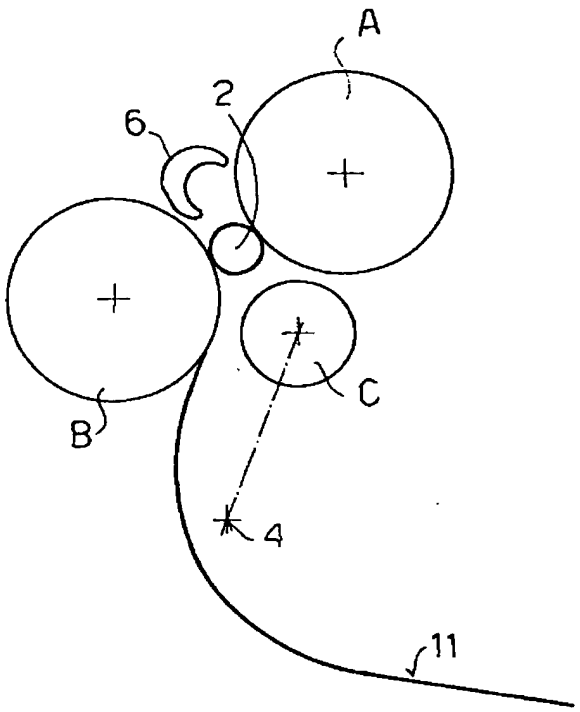


FIG.8

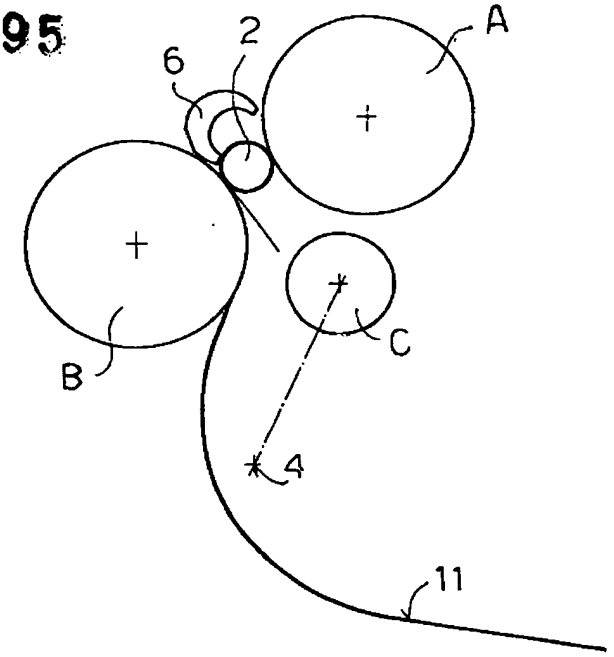


FIG.7

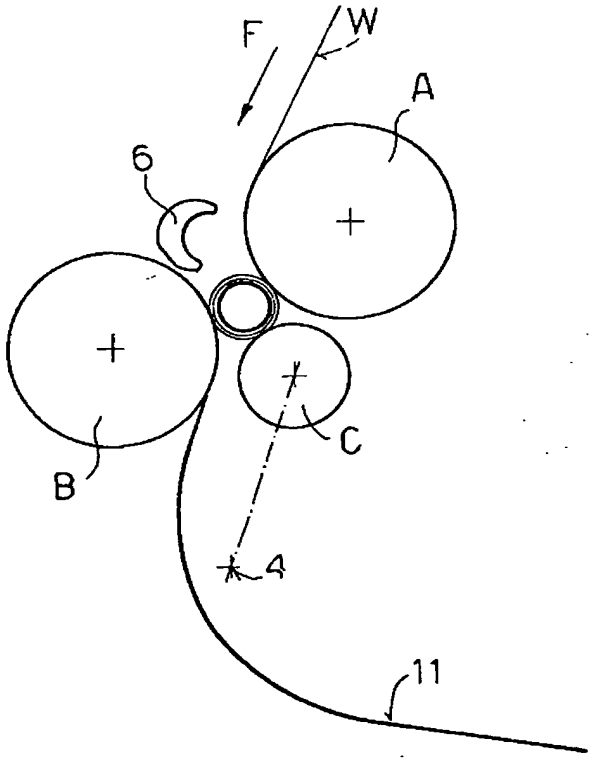
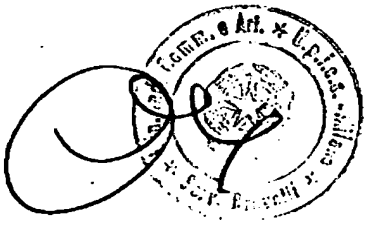


FIG.9



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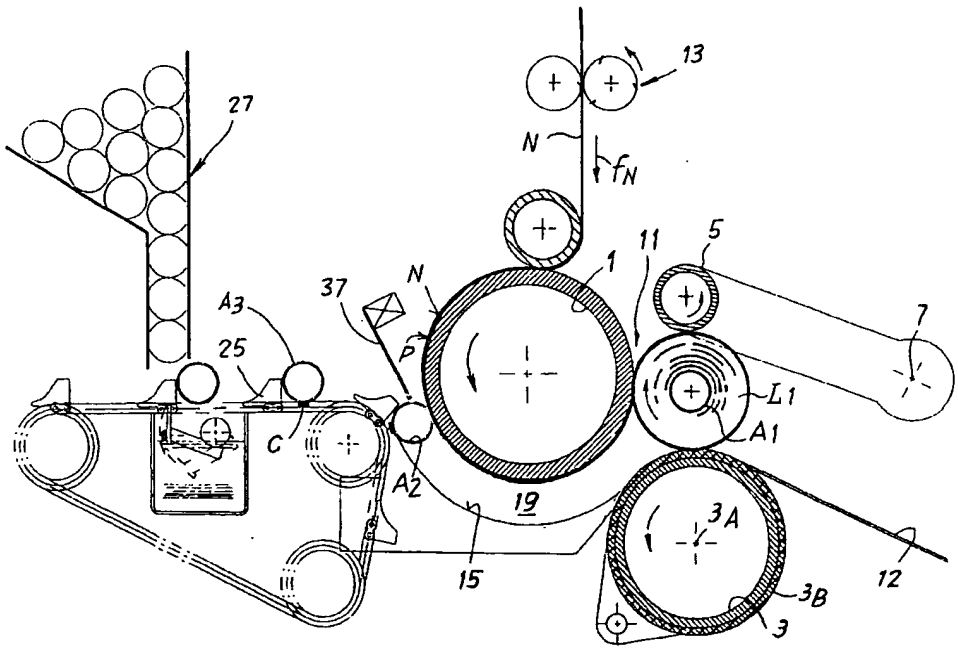
(54) Title: METHOD FOR PRODUCING LOGS OF WEB MATERIAL AND REWINDING MACHINE IMPLEMENTING SAID METHOD



(57) Abstract: A method for producing logs (L1, L2) of web material (N) wound around tubular cores wherein the tubular core (A1-A4) is equipped with glue to secure the initial end of the web material and allow winding. Part of the glue applied to the tubular core is transferred to the web material (N) before it is severed upon termination of winding the log, to seal the final free end of the formed log.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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METHOD FOR PRODUCING LOGS OF WEB MATERIAL AND REWINDING MACHINE IMPLEMENTING SAID METHOD

DESCRIPTION

Technical Field

The present invention relates to a method for producing logs of web material, for example rolls of toilet tissue, kitchen towels or the like.

The invention also relates to a rewinding or winding machine for forming logs destined to produce small rolls of wound web material.

State of the Art

Currently, to produce rolls of toilet tissue, rolls of kitchen towels or similar products a web material is unwound from one or more parent reels of large diameter, coming directly from the paper mill, and predetermined quantities of web material are rewound on tubular winding cores to obtain logs of a length equivalent to the length of the parent reel but with a minor diameter, equivalent to the diameter of the final product. These logs are subsequently cut crosswise to their axis to produce rolls or small rolls of web material destined to be packaged and distributed. Before cutting the logs into small rolls with lower axial dimensions, the initial free end of the web material must be glued to adhere to the external surface of the log and thereby allow subsequent handling, without the risk of accidentally unwinding the web material.

The rewinding machines currently used wind the logs, which are then conveyed to a gluing unit that glues the final free end of the web material. For this purpose, the individual logs are partially unwound and positioned to apply the glue to the unwound free end or to a portion of the cylindrical surface of the log that is subsequently covered with the final free end of the material by rewinding it.

Examples of gluing units to seal the final end of a web material forming a log are described in US-A-5242525, EP-A-0481929, US-A-3393105, US-A-3553055, EP-A-0699168.

To produce logs of web material rewinding machines of the so called peripheral type are preferably used, in which the log being formed is made to rotate through contact with a plurality of motor-driven winding rollers, a plurality of belts or with combined systems of belts and rollers. Examples of rewinding machines of this type are described in WO-A-9421545, US-A-4487377, GB-B-2150536 and others.

With these traditional machines at least a rewinding machine and a gluing unit are required to obtain the completed and glued log, ready to be subsequently cut

into small rolls. US-A-4487377 describes a method that makes the use of a gluing unit downstream of the rewinding machine unnecessary. In this method, the web material is cut upon termination of winding a log and the final end of the web material of the completed log is glued after cutting by transferring to it a glue previously distributed in annular strips on the tubular winding core introduced into the winding area. The glue applied to the tubular core also serves to start winding the new log.

This system makes it possible to eliminate the gluer, although it requires a particular configuration of the rewinding machine, with a cutting blade disposed so as to cooperate cyclically with the winding roller. With a layout of this type it is not possible to attain the performances currently required of these machines in terms of production speed and production flexibility.

WO-A-9732804 describes a rewinding machine with a gluing unit incorporated. Nonetheless, owing to the design and layout of the gluing unit, this rewinding machine is only capable of reaching relatively low winding speeds. Moreover, even if the winding elements and the gluing elements are incorporated in the same machine, it still has a gluing unit which is separated in respect of to the elements to wind the web material on the previously glued tubular cores.

WO-0164563 describes a rewinder wherein, upon termination of winding a log, a first glue is applied to the web material to seal the free end of the formed log. A second glue is applied to the new winding core before it is introduced into the machine.

Objects and summary of the invention

The object of the present invention is to provide a method for producing logs of wound web material, that makes it possible to glue the final end of the rolls or logs, without requiring a gluing unit downstream of the rewinding machine or incorporated in it, and which makes it possible to obtain a high level of precision in applying the glue to the web material to seal it.

According to a particular aspect a further object of the present invention is to provide a method that makes it possible to attain high performances in terms of production flexibility.

A further object of the present invention is to produce a rewinding machine that makes it possible, reaching adequate production speeds, to avoid the use of a gluing unit downstream of the rewinding machine, performing the operations to glue the final end of the log formed inside the rewinding machine, without requiring spe-

cific gluing elements.

The invention is based on a method per se known and described in US-A-4487377. This method includes the following phases:

- winding a quantity of web material around a first winding core to form a first log in a winding area
- upon termination of winding the first log, bringing a second winding core, provided with glue on its surface, into contact with said web material;
- severing the web material to produce a final end of the first log and an initial end to form a second log around said second winding core;
- transferring a part of the glue from the second winding core to a portion of web material destined to be wound on the first log, in proximity to the final free end, which is glued to the first log unloading said log from the winding area.

Characteristically, according to the invention, the glue is transferred from the winding core to the web material before the web material is severed to produce the final free end of the completed log and the initial free end of the new log to be wound.

As shall be apparent to those skilled in the art from the following description of a particularly advantageous example of embodiment, this makes it possible to implement the method in a particularly simple way and with a versatile and high speed rewinding machine.

According to an advantageous and preferred embodiment of the invention, the method is characterized by:

- feeding the web material around a first winding element;
- positioning a rolling surface at a distance from said first winding element to define with it a channel for introducing the winding cores;
- introducing said second winding core in said channel and making it roll, in contact with said rolling surface and with said web material fed around the first winding element;
- after said second core has transferred part of the glue to the web material, severing the web material between said second core and said first log;
- continuing to make said second winding core roll along said channel to start winding of the second log around it.

The glue may be applied to the tubular winding cores in annular bands. Nonetheless, according to a preferred embodiment of the invention, the glue is applied

along at least a longitudinal band, i.e. parallel to the axis of the tubular winding core. This longitudinal band may be suitably broken to prevent the glue applied from soiling the mechanical elements of the rewinding machine. In particular, when a rolling surface is provided to introduce the core into the winding area, this surface may be designed in the form of a comb, i.e. with an arrangement of elements parallel to and spaced apart from one another. The longitudinal band of glue applied to the core will be broken in areas corresponding to the position in which the core comes into contact with these supporting elements forming the rolling surface.

In an improved embodiment of the invention, two longitudinal bands are applied to the core, one destined to be transferred to the final free end of the completed log to seal it and the other destined to secure the initial free end of the web material to the new core. The two bands may be formed by glues with different characteristics, optimized for the two different functions.

Advantageously, the tubular core is introduced into the channel formed by the winding element and by the rolling surface in an angular position, such that the longitudinal band of glue applied to the tubular core is far from the contact area of the core with the web material fed around the winding element. In this way the tubular core starts to roll in the channel in contact with the web material fed around the winding element and the rolling surface for a sufficiently wide angle before the band of glue comes into contact with the web material. During this brief interval of time the web material may be tensioned through acceleration of a winding roller downstream of the area in which the tubular core is introduced, to prepare the web material for subsequent severing. Severing is obtained by exceeding the limit of tensile strength of the web material at the level of a perforation line provided on it. This severing occurs when the core is rolled for an angle greater than the one required to bring the longitudinal band of glue into contact a first time with the web material to deposit a fraction of the glue on the web material. Severing takes place along a perforation line located between the band of glue transferred to the web material and the core, before the band of glue on the core comes into contact for a second time with the web material. In this way the glue transferred to the web material is extremely near the line along which the web material is severed. Acceleration of the winding roller to obtain tensioning can also start after the glue has been transferred to the web material. The moment in which tensioning starts depends on the gradient of acceleration and on the characteristics of resistance and elasticity of the web material.

By applying glue along a longitudinal line, if necessary a broken line, makes it possible to distribute on the web material – in proximity to the area in which the final free end of the material wound on the finished log is produced – a longitudinal band of glue parallel to the edge of the free end.

Continuing to roll between the rolling surface and the winding element the core will make another complete turn until the longitudinal band of glue is once again brought into contact with the web material nipped between the core and the winding element. This new contact will take place after the web material has been severed and therefore the initial free end produced by severing will remain glued to the tubular core along the longitudinal band of residual glue on the core to start winding the subsequent log.

Further advantageous characteristics and embodiments of the method according to the invention are set forth in the appended dependent claims.

The invention also relates to a peripheral rewinding machine of the automatic and continuous type, i.e. in which the web material is fed continuously at an essentially constant speed and the logs formed are automatically unloaded to be replaced by new tubular winding cores. More specifically, the invention relates to a peripheral rewinding machine of this type comprising:

- a winding cradle with at least a first winding element around which said web material is fed;
- a feeding means to introduce said winding cores towards said winding cradle;
- means to sever the web material upon termination of winding each log;
- a glue dispenser to apply a glue to said cores, before introducing them into said winding cradle;

and wherein the feeding means and the means to sever the web material are synchronized so that a winding core is brought into contact with the web material fed around said first web element before the web material is severed.

Characteristically, according to the invention, introduction of the winding core and operation of the means to sever the web material are coordinated so that the web material is severed in an area upstream, in respect of the direction of feed of the web material, of an area in which said winding core transferred part of the glue applied to it to the web material.

Further advantageous characteristics and embodiments of the rewinding machine according to the invention are indicated in the appended dependent claims.

Brief description of the drawings

The invention will now be better understood by following the description and attached drawing, which shows a non-limiting practical example of the invention. In the drawing:

Figures 1 to 6 schematically show the principal elements of the rewinding machine in an operating sequence in the exchange phase, wherein the finished log is unloaded, a new winding core is introduced and winding of a new log starts; and

Figures7 and 8 show two alternative embodiments of the invention.

Detailed description of the preferred embodiment of the invention

Figure 1 shows the principal elements of the rewinding machine, the description of which shall be restricted to the description required to understand the present invention.

The rewinding machine, indicated as a whole with 1, comprises a first winding roller 1, rotating around an axis 1A, a second winding roller 3, rotating around a second axis 3A parallel to the axis 1A, and a third winding roller 5, rotating around an axis 5A parallel to the axes 1A and 3A and moving around an axis 7 of oscillation, around which oscillating arms 9 to support the winding roller 5 are supported. The three winding rollers 1, 3 and 5 define a winding cradle 11 inside which, in the position shown in Figure 1, a first log L1 of web material is found in the final winding phase.

A nip 6 is defined between the winding rollers 1 and 3 through which the web material N passes and is wound around to form the log L1. The web material N is fed around the first winding roller 1 and, before reaching it, through a perforator unit 13 that perforates the web material N along perforation lines equidistant and substantially orthogonal to the direction of feed of the web material. In this way the web material N wound on the log L1 is divided into sheets that can be separated individually by being torn by the final user.

A rolling surface 15, essentially concave cylindrical and coaxial to the winding roller 1, extends around a portion of said winding roller 1. The rolling surface 15 is formed by a series of strips parallel to and spaced apart from one another, one of which is shown in the drawing and indicated with 17, the others being superimposed on it. The strips 17 terminate with a narrow portion that is introduced into annular channels 3B of the second winding roller 3. The layout is analogous to the one described in WO-A-9421545, the content of which may be referred to for greater de-

tails concerning the construction of these rolling surfaces.

The rolling surface 15 forms, with the external cylindrical surface of the winding roller 1, a channel 19 to introduce the tubular winding cores. The channel 19 extends from an inlet area 21 to the nip 6 between the winding rollers 1 and 3. It has a height, in a radial direction, equal to or slightly below the diameter of the tubular winding cores, which must be sequentially introduced into the winding area in the manner described below.

The tubular winding cores are taken to the inlet 21 of the channel 19 by a conveyor 23 comprising two or more flexible elements parallel with one another and equipped with pushers 25 that collect each single tubular winding core A (A1, A2, A3, A4) from a hopper above 27. Under the hopper 27 is a glue dispenser, indicated as a whole with 29, comprising a tank of glue 31, inside which a moving gluing element 33 oscillating around an axis 35 orthogonal to the plane of the figure is immersed. The gluing element 33 alternatively adopts a first position (shown with a dashed line in Figure 1), wherein it is immersed in the glue contained in the tank 31, and a raised position, shown with a solid line in Figure 1, wherein it touches the tubular winding core in the lowest position in the core unloading channel under the hopper 27, that is core A4 in the figure. The gluing element 33 has a rim, equipped with an upward facing groove if needed, on which the glue is collected to be applied along a corresponding longitudinal band on each single core unloaded from the hopper 27 onto the conveyor 23 below, before being transferred with a movement according to the arrow fA towards the winding area. It must be understood that other conveying and gluing systems may be used to convey the tubular winding cores and to apply glue to them, preferably along longitudinal lines, that is parallel to the axis of said cores.

In the position in Figure 1 the tubular winding cores A2 and A3 are already equipped with a longitudinal band of glue, indicated with C. This band may be broken in positions corresponding to the positions in which the strips 17 are disposed, so that the longitudinal edge of the gluing element 33 has a series of breaks distributed appropriately along its extension.

The tubular winding core A2 is in proximity to the inlet 21 of the channel 19 and is held there by an elastic strip 37. It will be introduced at an appropriate moment into the channel 19 and will start to roll on the rolling surface 15 through the effect of contact with the web material N fed around the winding roller 1. Introduction is ob-

tained by a sudden movement of the conveyor 23 and through the effect of the thrust of the pusher 25, by an auxiliary introduction means of a per se known type (see for example WO-A-9421545) or in any other suitable way.

The rewinding machine summarily described hereinbefore operates as follows.

As mentioned above, Figure 1 shows a roll or log L1 in the terminal phase of winding onto a tubular winding core A1. The tubular winding core A2, equipped with the band of glue C, is at the inlet 21 of the channel ready to be introduced into the winding area. The web material N advances according to the arrow fN from the perforator 13 to the winding roller 1 until reaching the winding cradle 11 where it is wound around the log L1.

Figure 2 shows the phase to introduce the tubular core A2 into the channel 19. It is forced into the channel to come into contact with the web material N, pressing it against the cylindrical surface of the first winding roller 1, and with the rolling surface 15. Upstream of the contact point between the web material and the tubular core A2 the position of the perforation line P along which the web material will be severed in the manner described below is shown. The log L1 continues to be wound in the winding cradle 11. Introduction of the core is suitably synchronized with the position of the perforation line along which the web material must subsequently be severed.

Due to the rotating movement of the winding roller 1, the tubular winding core A2 rolls on the surface 15 advancing along the channel 19. In this movement the longitudinal band of glue C moves from the position in Figure 2 (wherein it was in an area of the core A2 diametrically opposite its contact area with the web material N) to the position in Figure 3, where the band of glue C is positioned in the contact area between the tubular winding core A2 and the web material N fed around the first winding roller 1. At this moment part of the glue C from the band is transferred to the web material N. This band is positioned slightly downstream of the perforation line along which the web material will be severed.

Continuing the rolling movement of the tubular winding core A2 along the channel 19, the position shown in Figure 4 is reached. The longitudinal band of glue C is again in a position more or less diametrically opposite in relation to the contact area between the tubular winding core A2 and the web material N fed around the winding core 1. The portion of glue transferred from the tubular winding core A2 to

an area of the web material N is indicated with C1.

Simultaneously, the third winding roller 5 as been accelerated and, if necessary, the second winding roller 3 has been decelerated. Consequently, the log L1 in the completion phase starts to move away from the first winding roller 1 and gets ready to be unloaded onto an unloading surface 12. Acceleration of the upper moving winding roller 5 also causes tensioning of the web material N in the area between the log L1 and the point in which the material is pinched between the winding roller 1 and the tubular winding core A2. This occurs because the speed at which the web material N is fed to the winding roller 1 and the peripheral speed of the latter remain constant, while the speed of the contact point between the log L1 and the winding roller 5 increases. At a certain point this increase in tension will exceed the breaking point of the web material along the perforation line predetermined for severing. This perforation line is disposed between the log L1 and the point in which the web material is pinched between the tubular winding core A2 and the first winding roller 1. The position of this perforation line may be adequately and precisely controlled in a per se known way.

Figure 5 shows a moment successive to severing the web material N. This severing produces a free tail end Lf, which will finish winding around the log L1, and a free leading end Li which will start winding around the new tubular winding core A2. The free tail end Lf is produced in close proximity to the band C1 of glue that the tubular core A2 has transferred to the web material N wound around the log L1. The free leading end Li will start to wind around the tubular core A2 through the web material being secured to the tubular core by the residual glue of the longitudinal band of glue C.

Figure 6 shows a subsequent phase of the winding cycle, wherein the completed log L1 is unloaded onto the unloading surface 12, while the tubular winding core A2 is in the winding cradle 11 and a certain quantity of web material has started to be wound around it to form the initial part of a new log indicated with L2. After oscillating upwards to allow unloading of the completed log L1, the winding roller 5 with moving axis returns to the low position and is once again in contact with the new log L2 being formed. The conveyor 23 has advanced by one step to take the tubular winding core A3 to the position previously occupied by the tubular winding core A2 (Figure 1). The peripheral speed of the winding rollers 3 and 5 has returned to the nominal value more or less equivalent to the peripheral speed of the winding

roller 1. In this position the machine is ready to start a new exchange cycle when the log L2 is completed and the winding core A3 will be introduced into the feed channel 19 in the same way described hereinbefore.

From the description hereinbefore it is clear that the logs L1, L2, etc. are equipped with a longitudinal band of glue C1 required to make the free tail end Lf adhere to the external surface of the log when it rolls onto the unloading surface 12. There is therefore no need to provide a gluing device disposed downstream of the rewinding machine. The absence of blades or other cutting elements makes it possible to reach a high level of production flexibility, as any quantity of web material may be wound.

The figures described hereinbefore show an example of embodiment wherein a single longitudinal band of glue is applied to the tubular core. The quantity of glue C is sufficient to wet the free tail end of the formed log and the free leading end destined to be secured to the new tubular core. Nonetheless, two longitudinal bands of glue may be applied to the same core in two different angular positions, one destined to glue the free tail end of the completed log and the other to secure the free leading end to the new core. In this case two different glues may be used for the two bands, taking into consideration the different gluing requirements. While the final free end of the log requires light gluing, the initial free end must adhere efficiently and rapidly to the new core.

Figure 7 shows a first embodiment of the machine that allows two bands of glue to be applied in two different angular positions using different glues. In this case two gluing elements 33A and 33B are provided immersed in two separate tanks containing two different glues. When the core is in the gluing position, it receives two bands C_C and C_T of glue of different qualities in different angular positions. The glue C_C is destined to glue the free tail end or tail edge of the completed log, while the glue C_T is destined to glue the free leading end to the new core.

Before each core is introduced into the channel 19 formed between the roller 1 and the rolling surface 15 it is made to rotate through more or less 180°, for example by a belt 34 disposed in a suitable position along the core introduction path. In this way, as shown schematically in Figure 7, the core is fed into the channel 19 in an angular position that brings the core and the web material into contact in the portion of cylindrical surface lying between the bands C_T e C_C. When the tubular core starts to roll along the channel 19 the band of glue C_C first touches the web material N and

the glue is transferred to an area adjacent to the line along which the material is severed, but downstream of said line. The core continues to roll and the material is severed as described hereinbefore, but the free leading end that must be secured to the core A is glued by the band of glue C_T that touches the web material after severing and after the core has rotated for slightly less than one complete turn.

Rather than applying the glue from below and rotating the core through 180°, it is also possible to apply the glue from above, again along two bands disposed appropriately on the core.

Figure 8 shows an embodiment modified in relation to the one in Figure 7 and wherein the tubular core is not rotated through 180° after the glue is applied. In this case the reciprocal position of the bands C_C and C_T is inverted so that the first band to touch the web material is again the band C_C. Less time is available to perform severing of the web material than in the previous case, as the second band of glue C_T touches the web material after a relatively small angle of rotation of the tubular core.

It is understood that the drawing merely shows an example given purely as a practical embodiment of the invention, which may vary in shapes and arrangements without however departing from the scope of the concept on which the invention is based. Any reference numbers in the appended claims are provided to facilitate reading of the claims with reference to the description and the drawing, and do not limit the scope of protection represented by the claims.

CLAIMS

1. Method for producing logs of wound web material, comprising the phases of:

- winding a quantity of web material (N) around a first winding core (A1) to form a first log (L1) in a winding area;
- upon termination of winding the first log, bringing a second winding core (A2), provided with glue (C; C_C, C_T) on its surface, into contact with said web material;
- severing the web material to produce a tail end (Lf) of the first log and a leading end (Li) to form a second log around said second winding core;
- transferring a part of the glue from the second winding core to a portion of web material destined to be wound on the first log, in proximity to the free tail end, which is glued to the first log unloading said log from the winding area,

characterized in that said portion of glue is transferred by the second core to the web material before severing of the web material.

2. Method as claimed in claim 1, characterized by:

- feeding the web material around a first winding element (1);
- positioning a rolling surface (15) at a distance from said first winding element to define with it a channel (19) for introducing the winding cores;
- introducing said second winding core (A1-A4) in said channel and making it roll, in contact with said rolling surface and with said web material fed around the first winding element;
- after said second core has transferred part of the glue to the web material, severing the web material between said second core (A2) and said first log (L1);
- continuing to make said second winding core roll along said channel starting winding of the second log (L2) around it.

3. Method as claimed in claim 1 or 2, characterized in that the web material is severed by tensioning said web material, downstream of the second winding core, to exceed the limit of tensile strength.

4. Method as claimed in claim 1, 2 or 3, characterized in that said glue (C; C_C, C_T) is applied to said winding cores (A1, A2, A3, A4) according to longitudinal bands.

5. Method as claimed in claim 4, characterized in that a single longitudinal band of glue (C) is applied to each core.

6. Method as claimed in claims 2 and 5, characterized in that the second

winding core (A2) is inserted into said channel (19) with the longitudinal band of glue (C) facing approximately opposite in respect of the contact area of said core with the web material.

7. Method as claimed in claim 4, characterized in that two longitudinal bands of glue (C_C, C_T) are applied to each core, to glue the free tail end of the first completed log and to secure the free leading end to the second winding core.

8. Method as claimed in claim 7, characterized in that said two bands are composed of glues with different characteristics.

9. Method as claimed in at least claim 3, characterized in that said web material is tensioned after the second core has been introduced into said channel.

10. Method as claimed in claims 3 and 6, characterized in that said core is made to rotate along said channel to complete approximately a full turn before severing said web material.

11. Method as claimed in at least one or more of the claims from 4 to 8, characterized in that said longitudinal bands of glue are discontinuous.

12. Method as claimed in at least claim 2, characterized in that said first winding element is a winding roller.

13. Method as claimed in claim 12, characterized in that at least a part of winding takes place in a winding cradle (11) defined by said first winding roller and by a second and a third winding roller (3, 5).

14. Method as claimed in claim 13, characterized in that the web material is severed by accelerating said third winding roller (5).

15. A peripheral rewinding machine to produce logs (L1, L2) of web material (N) wound around tubular cores, comprising:

- a winding cradle (11) with at least a first winding element (1) around which said web material (N) is fed;
- a feeding means (23) to introduce said winding cores (A1-A4) towards said winding cradle (11);
- means to sever the web material upon termination of winding each log (L1, L2);
- a glue dispenser (29) to apply a glue (C) to said cores, before introducing them into said winding cradle;

wherein said feeding means and said means to sever the web material are synchronized so that a winding core is brought into contact with the web material fed around said first web element before the web material is severed,

characterized in that introduction of the winding core and operation of the means to sever the web material are coordinated so that the web material is severed in an area upstream, in respect of the direction of feed of the web material, of an area in which said winding core transferred part of the glue applied to it to the web material.

16. Rewinding machine as claimed in claim 15, characterized by a rolling surface (15) defining with said first winding element (1) a channel (19) to introduce said winding cores (A1. A4); and wherein said winding cores are introduced into said channel and made to rotate inside it before severing of the web material.

17. Rewinding machine as claimed in claim 15 or 16, characterized in that said means to sever the web material comprise at least a winding roller (5) associated with acceleration means, which cause acceleration of said winding roller to tension and sever the web material between the completed log (L1) and a new winding core (A2).

18. Rewinding machine as claimed in one or more of the claims from 15 to 17, characterized in that said glue dispenser applies said glue along longitudinal bands on said cores.

19. Rewinding machine as claimed in claim 18, characterized in that said glue dispenser applies said glue along a single longitudinal band on each core.

20. Rewinding machine as claimed in claims 16 and 19, characterized in that said glue dispenser, said feeding means and said channel are disposed so that the cores are introduced into the channel with the longitudinal band of glue facing approximately in the opposite direction to the contact area between the tubular winding core and the web material fed around said first winding element.

21. Rewinding machine as claimed in one or more of the claims from 15 to 18, characterized in that said glue dispenser applies, on each core, at least two separate longitudinal bands of glue.

22. Rewinding machine as claimed in claim 21, characterized in that said dispenser dispenses glues of different types along said two longitudinal bands.

Fig.1

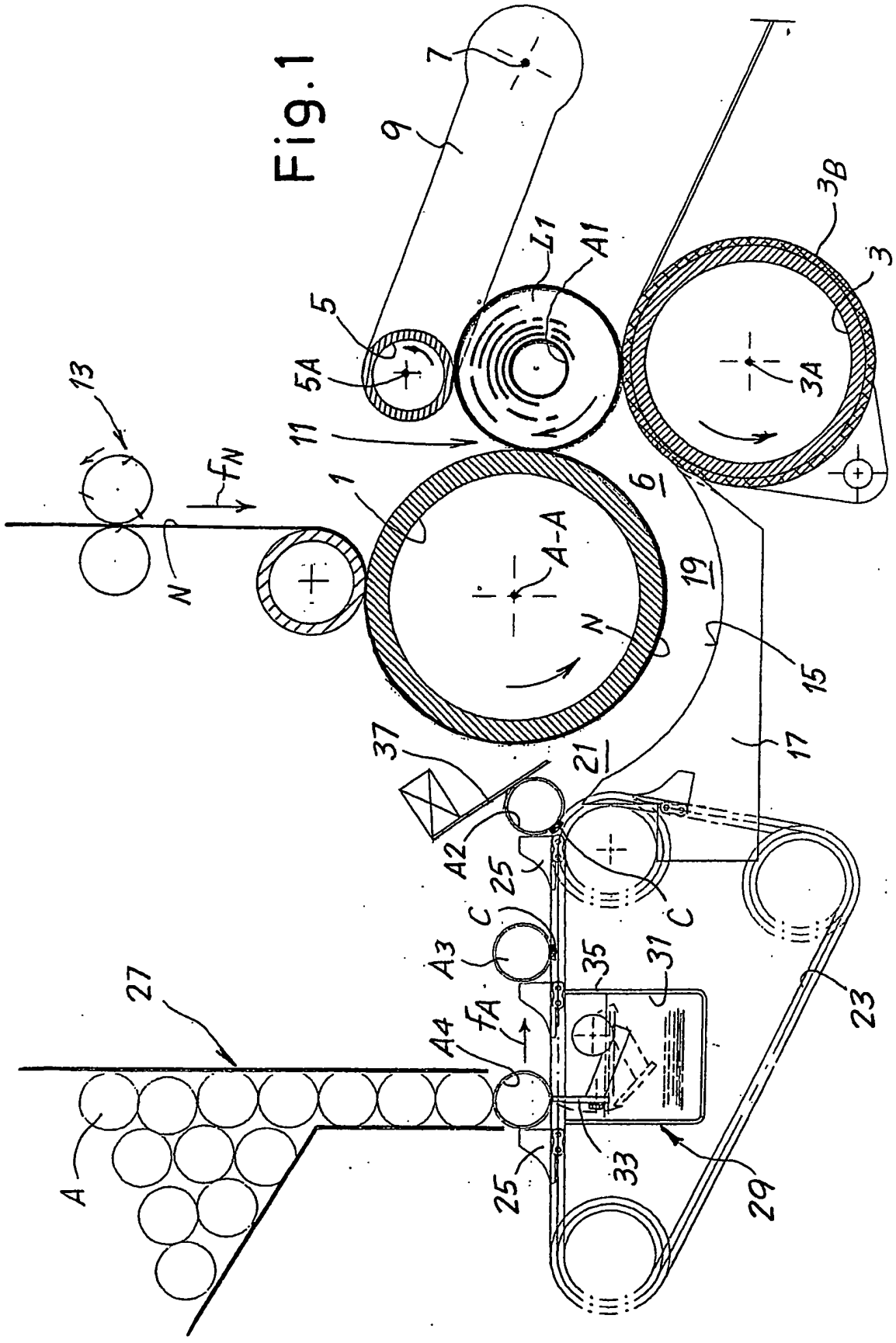
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Fig.2

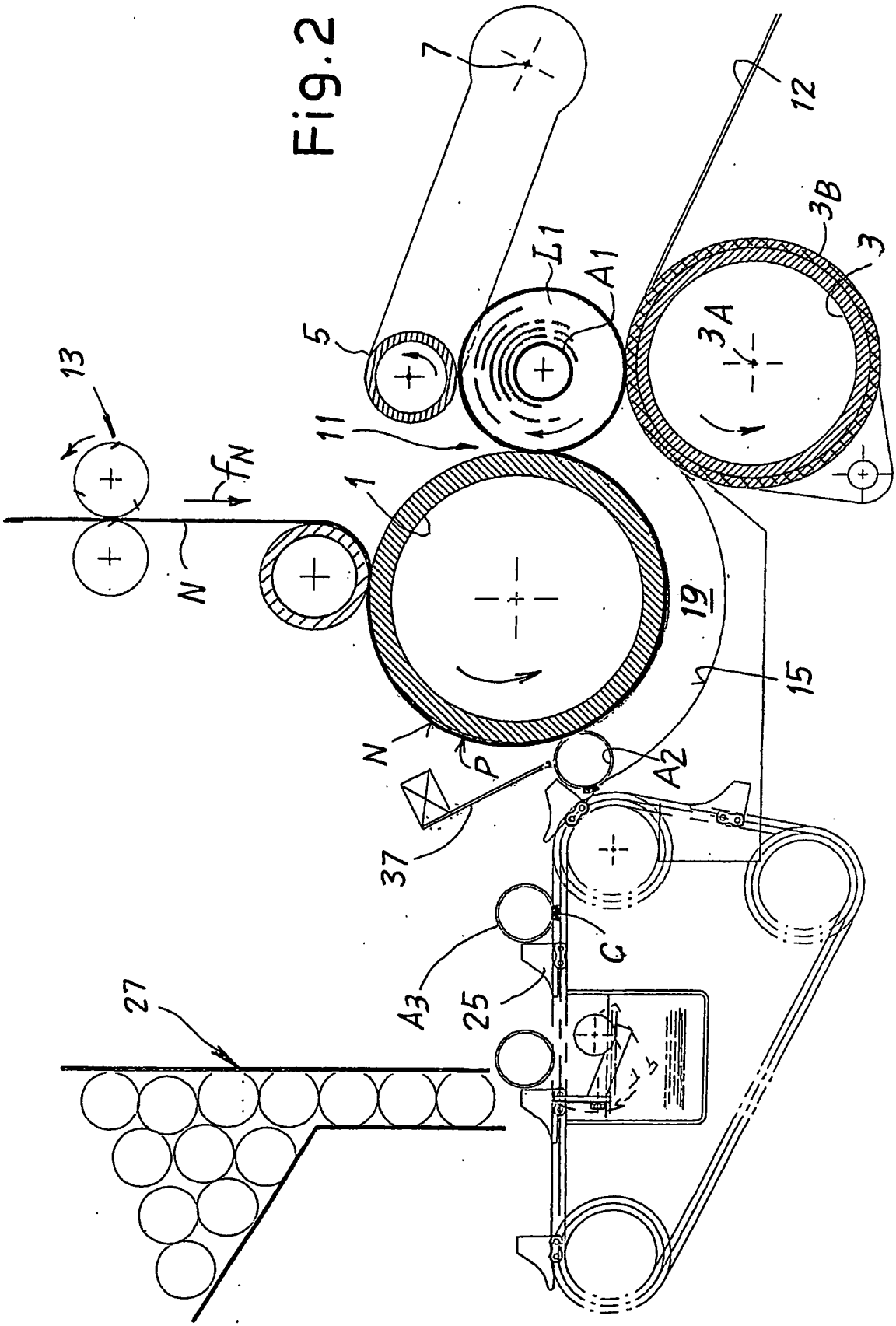


Fig.3

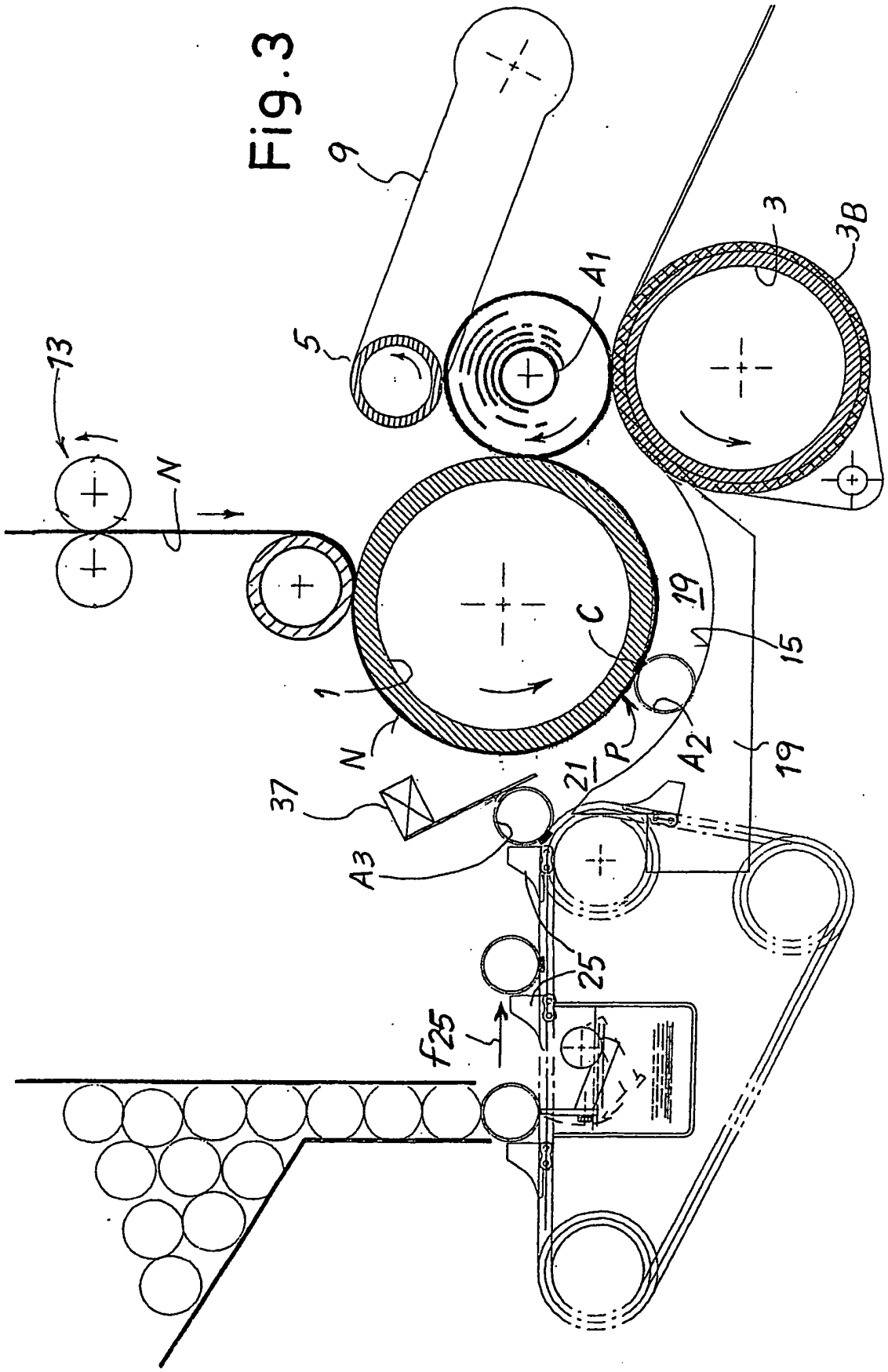


Fig. 4

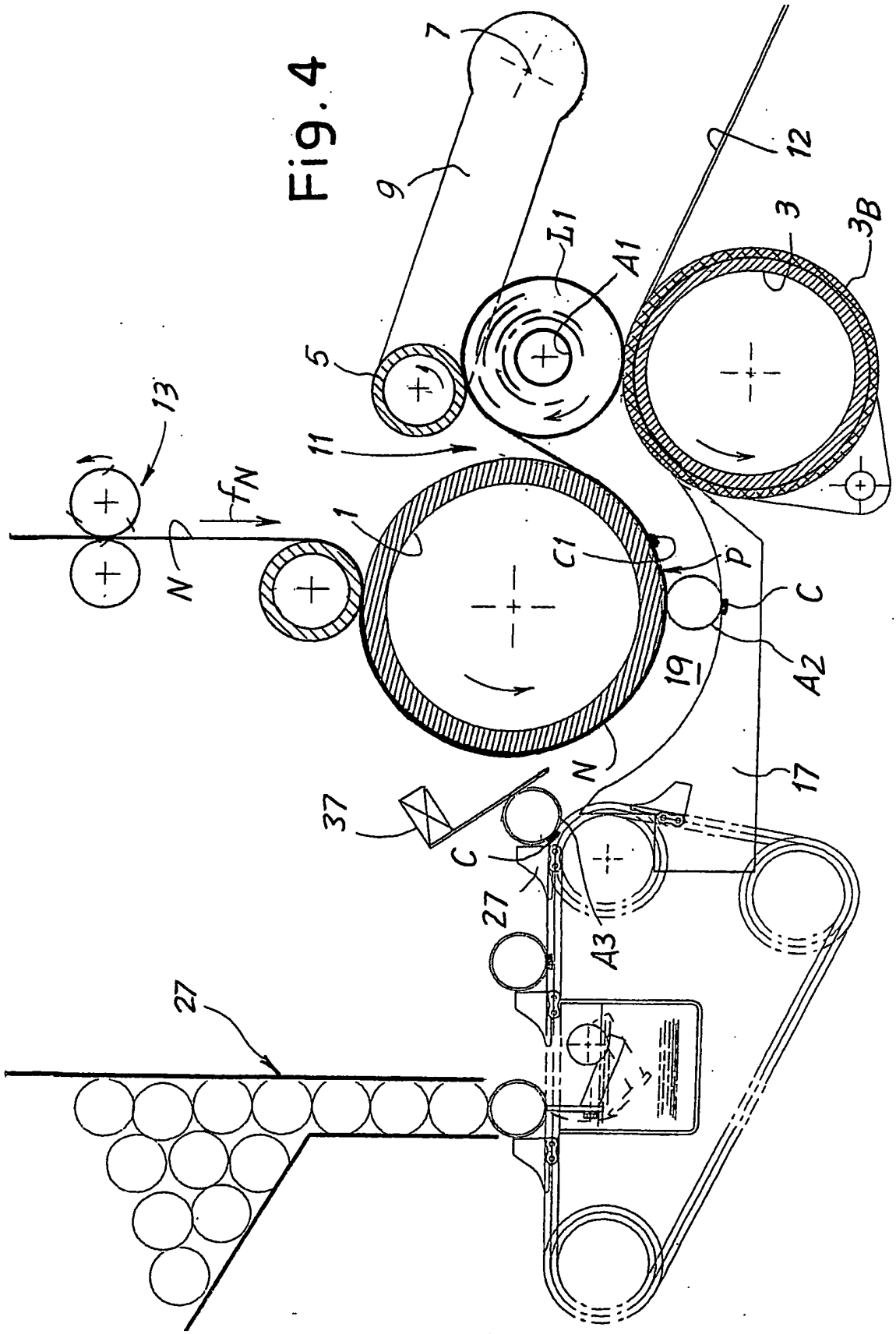
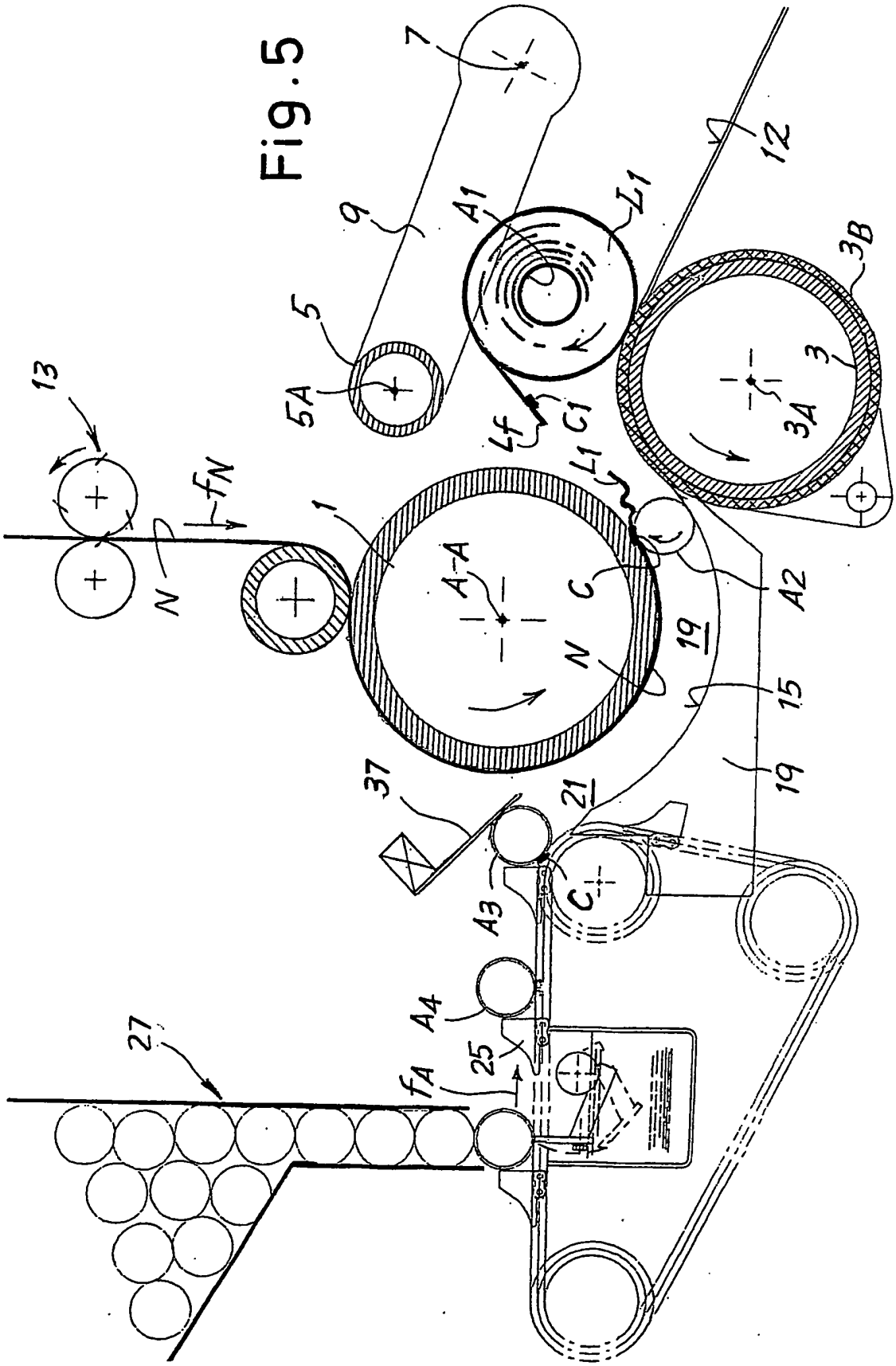


Fig.5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13
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Fig.6

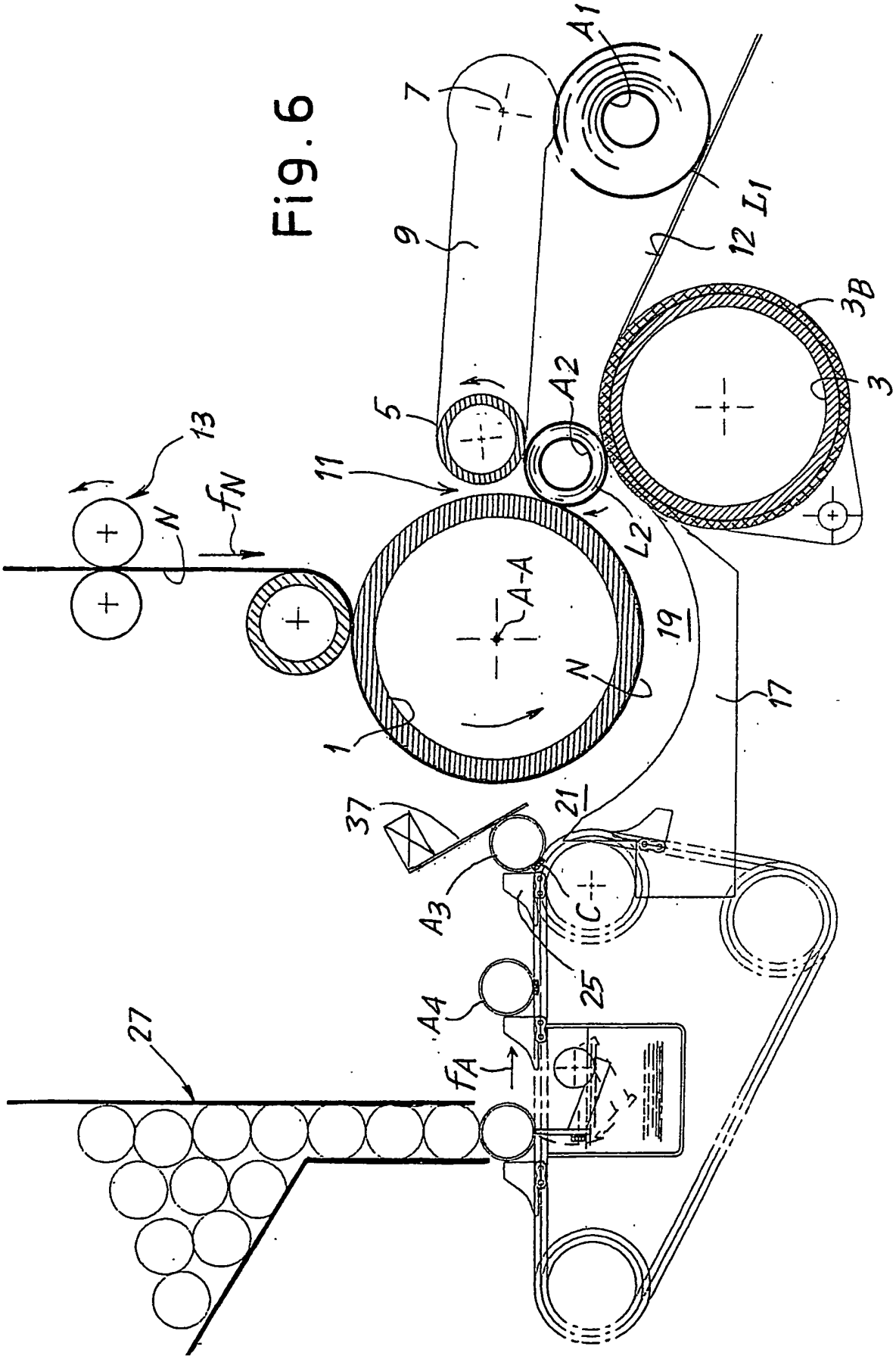

Fig. 7

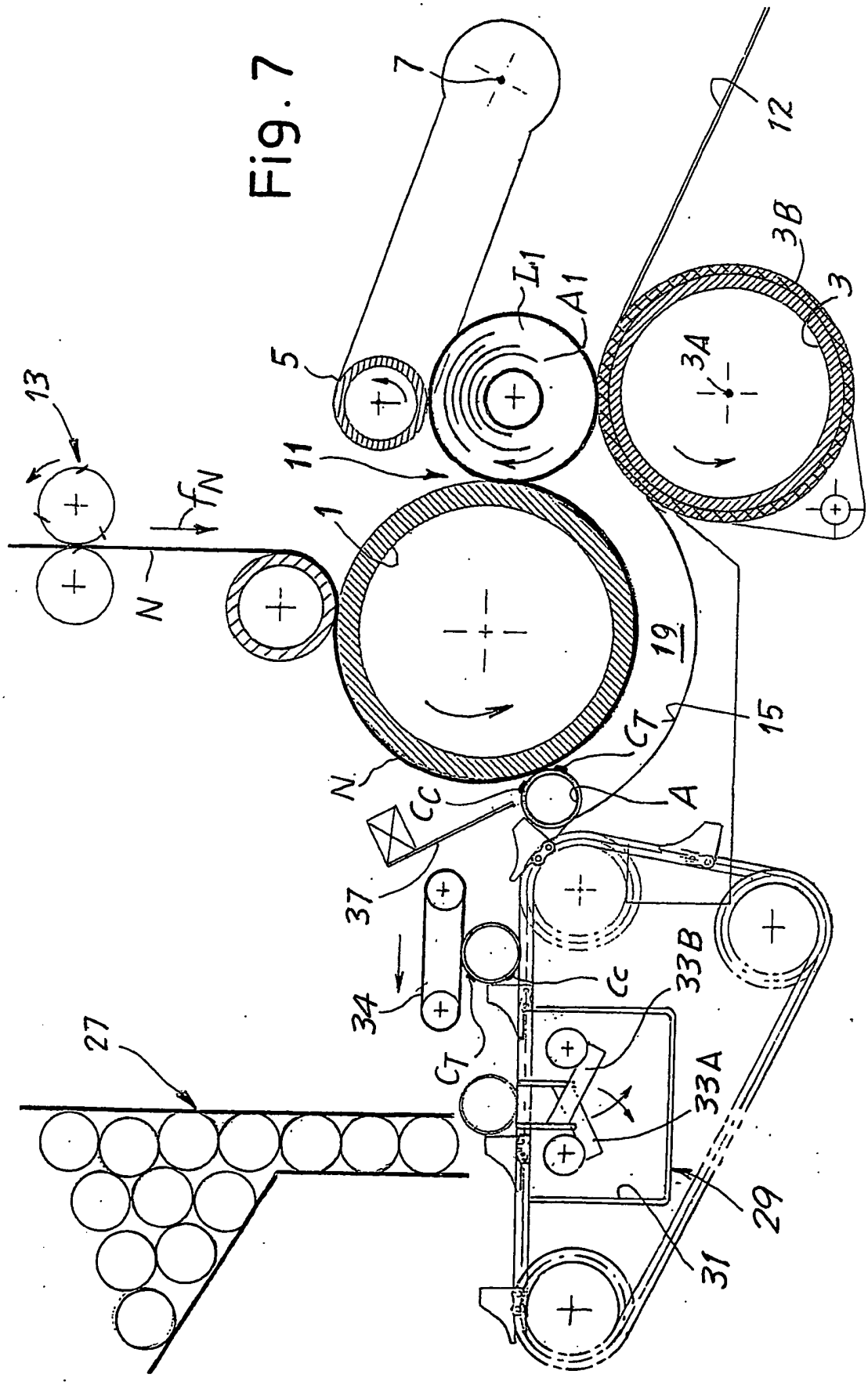
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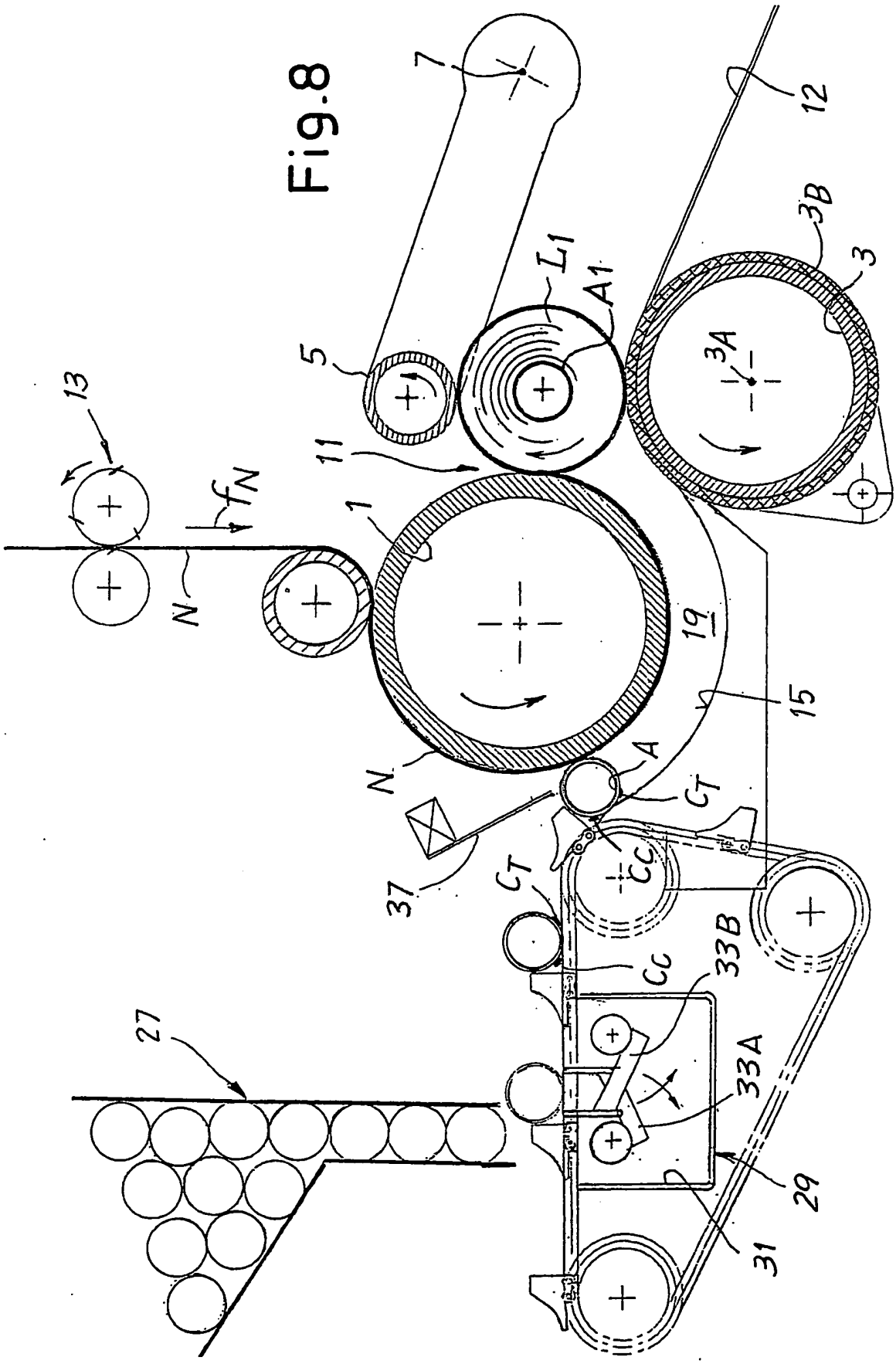
Fig.8



INTERNATIONAL SEARCH REPORT

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PCT/IT 03/00624

A. CLASSIFICATION OF SUBJECT MATTER
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B. FIELDS SEARCHED

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IPC 7 B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 487 377 A (PERINI FABIO) 11 December 1984 (1984-12-11) cited in the application column 9, line 39-54; figure 7	1,15
A	EP 1 006 066 A (PAPER CONVERTING MACHINE COMPANY) 7 June 2000 (2000-06-07) paragraphs '0018!-'0024!; figures 1-7	1,15

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Stroppa, G

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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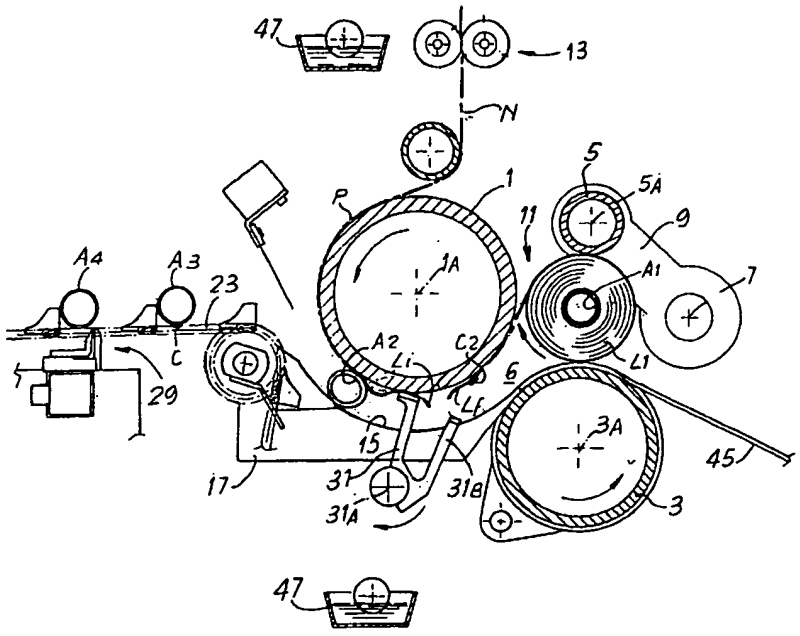
(54) Title: REWINDING MACHINE WITH GLUING DEVICE TO GLUE THE FINAL EDGE OF THE LOG FORMED AND RELATIVE WINDING METHOD



(57) Abstract: The rewinding machine comprises: winding elements (1, 3, 5) to wind the web material (N) and form the logs (L1, L2); at least a first glue dispenser (31B) to apply a first glue (C2) to a portion of said web material, in proximity to a severing line, along which the web material is severed upon termination of winding a log. The first glue dispenser comprises a mechanical element (31B) that touches the web material (N) upon termination of winding each log (L1, L2), to transfer the first glue to the web material (N).

WO 2004/046006 A2

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

REWINDING MACHINE WITH GLUING DEVICE TO GLUE THE FINAL EDGE OF THE LOG FORMED AND RELATIVE WINDING METHOD

DESCRIPTION

Technical field

The present invention relates to a method for producing logs of web material, for example rolls of toilet tissue, kitchen towels or the like.

The invention also relates to a rewinding or winding machine for forming logs destined to produce small rolls of wound web material.

The invention relates in particular, although not exclusively, to rewinding machines of the peripheral type, i.e. in which the log is formed in a winding cradle in contact with moving elements that transmit rotatory movement to the log through surface contact.

State of the art

Currently, to produce rolls of toilet tissue, rolls of kitchen towels or similar products a web material is unwound from one or more parent reels of large diameter, coming directly from the paper mill, and predetermined quantities of web material are rewound on tubular winding cores to obtain logs of a length equivalent to the length of the parent reel but with a minor diameter, equivalent to the diameter of the final product. These logs are subsequently cut crosswise to their axis to produce logs or small rolls of web material destined to be packaged and distributed. Before cutting the rolls or logs into small rolls with minor axial dimensions, the initial free edge of the web material must be glued to adhere to the external surface of the log and thereby allow subsequent handling, without the risk of accidentally unwinding the web material.

The rewinding machines currently used wind the rolls or logs, which are then conveyed to a gluing unit that glues the final free edge of the web material. For this purpose, the individual logs are partially unwound and positioned to apply the glue to the unwound free edge or to a portion of the cylindrical surface of the log that is subsequently covered with the final free edge of the material by rewinding it.

Examples of gluing units to seal the final edge of a web material forming a log are described in US-A-5242525, EP-A-0481929, US-A-3393105, US-A-3553055, EP-A-0699168.

To produce logs of web material rewinding machines of the peripheral type are preferably used, in which the log being formed is made to rotate through contact with a plurality of motor-driven winding rollers, a plurality of belts or with combined systems of belts and rollers. Examples of rewinding machines of this type are described in WO-A-9421545, US-A-4487377, GB-B-2150536 and others.

With these traditional machines at least a rewinding machine and a gluing unit are required to obtain the completed and glued log, ready to be subsequently cut into small rolls. US-A-4487377 describes a method that makes the use of a gluing unit downstream of the rewinding machine unnecessary. In this method, the web material is cut upon termination of winding a log and the final edge of the web material of the completed log is glued after cutting by transferring to it a glue previously distributed in annular bands on the tubular winding core fed into the winding area. The glue applied to the tubular core also serves to start winding the new log.

This system makes it possible to eliminate the gluing unit, although it requires a particular configuration of the rewinding machine, with a cutting blade disposed so as to cooperate cyclically with the winding roller. With a layout of this type it is not possible to attain the performances currently required of these machines in terms of production speed and production flexibility. Moreover, the quality of gluing is poor, as the glue is distributed according to arcs of circumference, rather than along a line parallel to the axis of the log, which are also spaced at a considerable distance from one another in an axial direction.

WO-A-9732804 describes a rewinding machine with a gluing unit incorporated. Nonetheless, owing to its design and to the layout of the gluing unit, this rewinding machine is only capable of reaching relatively low winding speeds. Indeed, gluing takes place by substantially decreasing the feed speed of the web material during the exchange phase, i.e. when a finished log is unloaded from the winding area and winding of a new log commences.

WO-0164563 describes a rewinder wherein, upon termination of winding a log, a first glue is applied to the web material to seal the free edge of the formed log. A second glue is applied to the new winding core before it is fed to the machine. The first glue is applied with a system of nozzles, which

have some drawbacks, in particular due to the fact that, especially at high production speeds, they are unable to apply the glue in a precise and definite way. The glue applied to glue the final edge of each log is not distributed optimally, especially when the production speed (that is the feed speed of the web material) is high. This poses a considerable problem, in particular when producing rolls of toilet tissue or the like with a small diameter, especially for domestic use where the accuracy of gluing the free edge of the log is essential.

Objects and summary of the invention

The object of the present invention is to provide a method and a rewinding machine for producing logs of wound web material, which make it possible to accurately glue the final edge of the logs or logs, without requiring a gluing unit downstream of the rewinding machine or incorporated in it.

According to a particular aspect a further object of the present invention is to provide a method and a machine that make it possible to attain high performances in terms of production flexibility.

In substance, according to the invention, a rewinding machine is provided, preferably although not exclusively of the peripheral type, comprising in combination: winding elements to wind the web material in logs; means to sever the web material upon termination of winding each log; at least a first glue dispenser to apply a first glue to a portion of said web material, in proximity to a severing line, along which the web material is severed upon termination of winding a log to form a final free edge and an initial free edge, said first glue gluing the final free edge of the log. Characteristically, according to the invention the first glue dispenser comprises a mechanical element that touches the web material upon termination of winding each log, to transfer said first glue to the web material.

When, according to the preferred embodiment of the invention, the rewinding machine is of the peripheral type, it comprises a winding cradle and at least a first winding element around which said web material is fed. The glue dispenser can cooperate with said first winding element, the web material passing between the glue dispenser and the winding element.

The use of a mechanical element to apply glue through contact with the web material, rather than nozzles that spray glue on the web material,

makes it possible to obtain a product of higher quality, wherein the free edge of the log is easily detached to allow use of the roll by the user, without damaging the layers of web material below, with minimum waste of material and accurate and precise metering of the glue.

The glue to make the final free edge of the log formed adhere can be a liquid or semi-liquid glue. Nonetheless, it would be possible also to use a non-liquid glue, for example in the form of a double-sided adhesive tape. In this case, the glue dispenser is provided with an element that if necessary prepares a length or several lengths of adhesive tape and subsequently applies it or them to the web material. The use of a non-liquid glue has the advantage of not weakening the web material and thereby does not create a preferential tear line or area other than the perforation line chosen to sever the web material. When, on the contrary, the glue is liquid or semi-liquid, in certain cases the glue can be applied subsequent to tearing or severing the web material, thereby preventing the material from tearing along the line of application of the glue instead of along the perforation line.

Winding can take place around a tubular core, on which a second glue can be applied if necessary by means of a second dispenser. The first and the second glue may be of a different nature, to satisfy the different requirements to glue the final free edge of a complete log and to fasten the initial free edge of a new log to the winding core. However, the invention may also be implemented on a rewinding machine that produces logs without a central winding core, such as a rewinding machine of the type described in EP-A-0580561.

Alternatively, the invention may be incorporated in a rewinding machine wherein the log is formed around a spindle or tubular winding core that is subsequently removed from the log, to obtain a finished product without a central core, as described for example in WO-A-0068129 or in WO-A-9942393. In this case a glue is not normally applied to the winding core or spindle but other temporary fastening systems of the initial free edge are used. Differently, water can be used instead of an actual glue and when it dries or is absorbed by the first turns of the wound material this allows the winding spindle or core to be subsequently removed with ease from the log formed.

According to a particularly advantageous embodiment of the invention, the first glue dispenser applies said first glue to a portion of the web material fed around the first winding element, which functions as a counter-pressure element.

The mechanical element of the first dispenser may be a rotating element, which is operated in synchronism with the exchange cycles, that is with the phases in which the web material is severed, a finished log is unloaded and a winding of a new log commences. This allows glue to be applied reliably and accurately, without damaging the web material.

According to an advantageous embodiment of the invention, the mechanical element that applies the glue to the web material has a pad suitable to pick up the glue and to touch the web material, in order to transfer at least part of the glue picked up to it. The glue may be picked up from a tank, from a dispensing roller or from another suitable element.

When the rewinding machine is designed to perform winding around a winding core, it typically comprises a feeder to feed the tubular winding cores on which the logs are wound to the winding cradle. Winding can commence by fastening the initial free edge of the new log to the tubular winding core by means of a glue. As already mentioned, this glue may be equal to or different from, as regards chemical and/or physical properties, the glue applied to seal the final free edge of the previously formed log. However, winding of the initial free edge of the new log around the winding core may be commenced in another way, instead of using a glue. For example, the winding core or spindle may have a suction system, as described in WO-A-0068129, or may be electrostatically charged, or yet again the first turn may be wound around the winding core with the aid of external air jets, or even a combination of the aforesaid means.

When the rewinding machine uses a feeder to feed the cores to the winding area, the mechanical element of the first glue dispenser may be associated with said feeder, for example it may be integral with it. In this way, correct synchronism between application of the glue to glue the final free edge of the completed log and feed of a new core are simple to obtain. Moreover, a particularly simple rewinding machine with a limited number of mechanical elements is obtained.

For example, the feeder of the cores may have an oscillating or rotating seat, with which the mechanical element of the glue dispenser is integral.

According to a different embodiment, the means to sever the web material upon termination of winding each log comprise a rotating severing element, cooperating with the first winding element (typically a winding roller). In this case, advantageously, the mechanical element of the first glue dispenser can be associated with said severing element. For example, the mechanical element of the glue dispenser may be integral with the severing element. Alternatively, it may be part of the actual severing element. Also in this case the structure of the rewinding machine is considerably simplified and its mechanical elements are reduced.

In an embodiment of this type when the severing element is in contact with the web material it may have a peripheral speed differing from the peripheral speed of said first winding element. According to the layout of the machine, this speed may be higher or lower than the speed of the first winding element. In the first case the web material is severed between the position in which the severing element touches the web material and the new winding core fed to the machine. In the second case severing typically takes place between the severing element and the log in the completion phase. According to the solution adopted, the position of the mechanical element that applies the glue to seal the final free edge of the finished log changes in respect of the severing element.

In a per se known way, the rewinding machine can have a rolling surface defining with the first winding element a channel for feeding the winding cores. The winding cores are fed into said channel and made to roll inside it before the web material is severed.

To obtain clean gluing of the final free edge of each log, consequently making the roll easy to open when it is used by the final consumer, the first glue dispenser applies glue along a longitudinal band, continuous or broken, on the web material, positioned at a suitable and modifiable distance from the edge of the material.

The invention also relates to a method to produce logs of wound web material, comprising the phases of: winding a quantity of web material to form a first log in a winding area; upon termination of winding said first log, sever-

ing the web material to create a final edge of the first log and an initial edge to form a second log; applying a first glue to a portion of the web material destined to remain wound on the first log, in proximity to the final free edge, which is glued to the first log unloading said log from the winding area. Characteristically, according to the invention, the first glue is applied to the web material by a mechanical element that comes into contact with said web material. Application may take place before or after severing of the web material.

Further advantageous characteristics and embodiments of the rewinding machine and of the method according to the invention are indicated in the appended claims.

Brief description of the drawings

The invention shall now be better understood by following the description and accompanying drawing, which shows a non-limiting practical example of the invention. In the drawing:

Figures 1 to 4 show a first embodiment of the rewinding machine according to the invention in four different moments of the winding cycle, in a schematic side view;

Figures 5 to 7 show a second embodiment of the rewinding machine according to the invention in three different moments of the winding cycle, again in a schematic side view;

Figures 8 to 11 show a third embodiment of the rewinding machine according to the invention in four different moments of the winding cycle, again in a schematic side view;

Figures 12 to 15 show a fourth embodiment of the rewinding machine according to the invention in four different moments of the winding cycle, again in a schematic side view; and

Figures 16 to 20 show a modified embodiment of the invention, in different operating positions of the rewinding machine.

Detailed description of the preferred embodiments of the invention

Figures 1 to 4 show, limited to its principal elements, a first embodiment of a rewinding machine according to the invention in four distinct positions during the winding cycle.

The rewinding machine, indicated as a whole with 2, comprises a first winding roller 1, rotating around an axis 1A, a second winding roller 3, rotat-

ing around a second axis 3A parallel to the axis 1A, and a third winding roller 5, rotating around an axis 5A parallel to the axes 1A and 3A. The winding roller 5 is supported by oscillating arms 9 hinged around an oscillation axis 7.

The three winding rollers 1, 3 and 5 define a winding cradle 11 inside which, in the position shown in Figure 1, a first log L1 of web material is found in the final winding phase.

A nip 6 is defined between the winding rollers 1 and 3 through which the web material N passes, which is wound around a tubular core A1 to form the log L1. The web material N is fed around the first winding roller 1 and, before reaching it, through a perforator unit 13 that perforates the web material N along the perforation lines equidistant and substantially orthogonal to the direction of feed of the web material. In this way the web material N wound on the log L1 is divided into sheets that can be separated individually by being torn by the final user.

A rolling surface 15, essentially concave cylindrical and substantially coaxial to the winding roller 1, extends around a portion of said winding roller 1. The rolling surface 15 is formed by a series of strips parallel to and spaced apart from one another, one of which is shown in the drawing and indicated with 17, the others being superimposed on it. The strips 17 terminate with a narrow portion that extends into annular channels 3B of the second winding roller 3. The layout is analogous to the one described in WO-A-9421545, the content of which may be referred to for greater details concerning the construction of this rolling surfaces.

The rolling surface 15 forms, with the external cylindrical surface of the winding roller 1, a channel 19 to feed the tubular winding cores. The channel 19 extends from an inlet area 21 to the nip 6 between the winding rollers 1 and 3. It has a height, in a radial direction, equal to or slightly less than the diameter of the tubular winding cores, which must be sequentially fed into the winding area in the manner described below.

In practice, the channel may increase gradually in height from the inlet to the outlet, to facilitate the increase in the diameter of the log in the first winding phase, when the first turns of web material are wound around the tubular core that rolls in the channel. For example, the height of the channel may be slightly less than the diameter of the winding core at the inlet of the

channel and slightly more than it at the level of the outlet.

The tubular winding cores are carried to the inlet 21 of the channel 19 by a conveyor 23 comprising two or more flexible elements parallel with one another and equipped with pushers 25 that pick up each single tubular winding core A (A1, A2, A3, A4) from a hopper or other container, not shown. Along the path of the cores A1-A4 carried by the conveyor 23 is a glue dispenser, indicated as a whole with 29, of a per se known type, which applies a longitudinal band of glue, continuous or broken, to each of the tubular cores traveling over it. It must be understood that other conveying and gluing systems may be used to convey the tubular winding cores and to apply glue to them, preferably along longitudinal lines, that is parallel to the axis of said cores.

In the layout in Figure 1 the tubular winding cores A2 and A3 have already been equipped with a longitudinal band of glue, indicated with C. This band may be broken in positions corresponding to the positions in which the strips 17 and the pushers 25, with the respective chains carrying them, are disposed.

The tubular winding core A2 is in proximity to the inlet 21 of the channel 19 and was fed by an auxiliary feeder 30 of a per se known type (see for example WO-A-9421545) or in any other suitable way, for example by a sudden movement of the conveyor 23 and through the effect of the thrust of the pusher 25. The auxiliary feeder 30 may be constituted with a comb structure to penetrate between the strips 17. The longitudinal band of glue C may be broken even at the level of the teeth forming the structure of the auxiliary feeder 30.

The log L1 formed around the tubular core A1 is in the completion phase. In an intermediate position, along the extension of the channel 19 is a severing element 31 that rotates around an axis of rotation 31A parallel to the axis of the winding rollers 1, 3, 5. In the position of Figure 1 the end of the severing element 31 is in contact with the web material N in an intermediate position along the arc of contact of the material with the winding roller 1. In the contact point with the severing element 31 the web material N is pinched between this element and the winding roller 1.

The peripheral speed of the severing element 31 is greater than the

peripheral speed of the winding roller 1 and therefore than the feed speed of the web material N. The latter is thereby drawn and tensioned in the portion between the point pinched by the severing element 31 and the point pinched by the tubular core A2. Tensioning causes the web material N to slide on the external surface of the winding roller 1 and finally tearing of the web material N along a perforation line produced by the perforator 13 and disposed between the new core A2 and the contact point with the severing element 31. Sliding of the material can be facilitated by the presence of annular bands with a low coefficient of friction on the cylindrical surface of the winding roller 1.

In practice, the severing element 31 is constituted by a series of teeth or slats parallel with one another and integral with a center body rotating around the axis 31A. Each of said teeth or slats passes between adjacent strips 15 in order to pass through the channel 19.

Each of the teeth or slats forming the severing element 31 is equipped at its end with a pad 41 impregnated with glue. When the pad 41 is pressed against the web material N it applies to it part of the glue with which it is impregnated. Consequently, a broken longitudinal band C2 of glue is applied along the crosswise extension of the web material N.

Figure 2 shows a successive phase of the operating cycle of the rewinding machine. In this phase the web material N has been torn between the contact point with the severing element 31 and the new winding core A2 fed into the channel 19. The core A2 is rolling along the channel 19, in contact with the fixed rolling surface 15 and the rotating surface of the winding roller 1. The free edge Li that was formed following severing adheres to the tubular core A2 thanks to the band of glue C, while the free edge Lf, which constitutes the final edge of the log L1, will be glued to the log L1, by the band of glue C2 applied by the pads 41 in the manner described hereunder.

Figure 3 shows a subsequent phase wherein the severing element 31, continuing its rotatory movement around the axis 31A, has left the channel 19, while the core A2, on which the first turn of web material is being wound, moves towards the nip 6 between the winding rollers 1 and 3. The finished log L1 starts to move away from the winding cradle by means of a variation in the peripheral speed between the rollers 3 and 5, for example by acceleration

of the roller 5 and/or deceleration of the roller 3.

To make the final free edge Lf adhere to the periphery of the finished log, this is made to rotate between the two rollers 3 and 5, through appropriate control of their peripheral speeds. By making the log L1 make at least one complete turn in this position the final free edge Lf is pressed against the log and glued to it.

After the web material has been severed and before the final free edge adheres completely to the finished log, the tail portion of the web material adheres lightly to the winding roller 1 through the aerodynamic effect and also due to the presence of annular areas of material with a high coefficient of friction that in a per se known way are provided on the cylindrical surface of the roller 1 and tend to hold the web material N.

The difference in peripheral speed between the rollers 3 and 5, after adhesion of the final free edge Lf to the finished log L12, will unload the log to an unloading surface 45. To allow ejection of the log the upper winding roller 5 is raised and subsequently lowered to come into contact with the new log L2 to be formed in the subsequent cycle.

Figure 4 shows a moment during winding of the new log L2 of web material around the tubular core A2 that has reached the winding cradle between the rollers 1, 3 and 5. The roller 5 has been lowered and is in contact with the log L2 being formed. It will oscillate gradually upwards to allow increase in the diameter of the log. The log L1 has been completely unloaded, while the new core A3 has reached a stand-by position to be fed at a subsequent moment (when the log L2 has been completed) into the channel 19 by the pusher 30.

Figure 4 also shows how the pads 41 carried at the ends of the teeth or slats forming the severing element 31 are soaked with glue. For this purpose they are brought into contact with a glue applicator, indicated as a whole with 47. In the example shown this applicator has a glue tank inside which a pick-up roller rotates, partially immersed in the glue contained in the tank. Other solutions are naturally possible, such as a system of nozzles, a slit to deliver glue by overflow or the like. The severing element may remain in this angular position during winding of the log L2 and only recommence its rotatory movement just before the log L2 is completed.

In this embodiment glue is applied by the severing element 31 that severs, i.e. tears the web material. This on the one hand simplifies the structure of the machine, as gluing takes place without providing an additional mechanical element, but using for this purpose (with appropriate modifications) an element already present for other operations. On the other hand this solution makes it possible to maintain, during the exchange phase, that is the phase to sever the web material, unload the log and commence a new winding cycle, an essentially continuous feed speed of the web material.

Figures 5, 6 and 7 show – in different operating positions - an embodiment modified in respect of the one shown in Figures 1-4. Equal numbers indicate parts equal or corresponding to those in the previous embodiment. In this case the severing element, once more marked with 31, does not operate directly as a glue applicator, but has an assembly of rods 31B integral with it, at the ends of which pads 41, destined to be soaked with glue, are integral. When the severing element is in the operating position, as shown in Figure 5, the pads 41 are in a position further forward in respect of the severing element 31, that is downstream of it in respect of direction of feed of the web material N, and no longer in contact with said web material. With this layout severing of the web material N can be obtained in a point between the finished log L1 and the point in which the web material N is pinched between the severing element 31 and the winding roller 1. This is obtained by operating the severing element 31 at a lower peripheral speed than the peripheral speed of the winding roller 1. By suitably phasing movement of the severing element 31, and thereby of the glue dispenser 31B, 41, with the position of the perforation lines produced on the web material by the perforator unit 13 it is possible to make the web material tear along a perforation line that is positioned between the point in which it was touched by the pads 41 and the point in which it is pinched by the severing element 31. This solution is particularly advantageous due to the reduced rotation speed of the severing element 31 and of the glue dispenser 31B integral with it. The lower rotation speed reduces the centrifugal effect on the glue with which the pads carried by the dispenser 31B are soaked and this makes it possible to increase the feed speed of the web material N without the risk of the glue, owing to the centrifugal force, being sprayed from the dispenser 31B.

On the contrary, relinquishing this advantage, also in this embodiment the severing element 31, and therefore the glue dispenser 31, can be made to move at a higher peripheral speed than the peripheral speed of the winding roller 1, causing the web material N to tear or be severed upstream of the point in which it is pinched, as described with reference to the previous embodiment.

The glue is applied to pads 41 with a roller applicator, indicated as a whole with 47. Differently to the description in the previous example, in this case the glue applicator roller is provided with a movement to move it towards and away from the axis of rotation 31A of the unit formed by the severing element 31 and the dispenser element 31B, 41. In this way glue is not applied to the severing element 31. The alternate movement of the glue applicator roller may be relatively slow, as it must only act once for each turn of the unit 31, 31B around the axis 31A, which takes place once during each winding cycle, i.e. for each log produced.

According to an alternative embodiment, not shown, the position of the elements 31 and 31B can be inverted, in which case the web material N will be severed necessarily upstream of the point in which it is pinched by the severing element 31, moving this at a higher peripheral speed to the peripheral speed of the winding roller 1 in the severing phase. In this case tearing or severing of the web material will preferably take place after having applied the glue C2 to it to seal the final free edge Lf of the log. This is due to the fact that the point in which glue is applied is weakened by the liquid content of the glue, which, (in the case of paper web material) reduces the mechanical resistance to traction. This could cause the web material to tear at the level of the line of glue C2 instead of at the level of the perforation line along which tearing has been programmed.

Figures 8 to 11 show, in different operating positions, a further embodiment of the machine according to the invention. Equal numbers indicate equal or corresponding parts to those in the previous embodiments. Extending upstream of the nip 6 between the winding rollers 1 and 3 is a rolling surface, indicated once more with 15, which may be constituted by a series of strips or by a continuous section bar and which extends to a lesser extent than the rolling surface 15 of the previous embodiments.

Disposed underneath the inlet of the channel 19 formed between the surface of the winding roller 1 and the rolling surface 15 is a hopper 81 inside which the winding cores A1-A4 are fed in sequence, already provided with a longitudinal band (continuous or broken) of glue C. The cores may be introduced, for example, with a longitudinal movement. A pusher 83, oscillating around an axis 83A parallel to the axes 1A, 3A, 5A of the winding rollers 1, 3, 5 picks up the core that is positioned time by time in the hopper 81 and feeds it into the channel 19 between the rolling surface 15 and the cylindrical surface of the winding roller 1. The dimension of the channel is equal to or slightly less than the external diameter of the tubular core, which is thereby forced into the channel 19 and made to roll on the fixed surface 15 through the effect of the rotatory movement of the winding roller around which the web material N is fed, which is pinched between the core and the roller 1.

Alternative solutions to feed the winding cores into the channel 19 are naturally possible. For example the cores may be fed by means of a feeder equipped with a hypocycloid movement or with any other known system. Preferably, they will in any case be equipped with a longitudinal band of glue C, although the use of annular bands of glue is not excluded a priori, which may also be adopted in the other embodiments described. In this second case the rolling surface 15, as in the previous examples, will preferably not be continuous, to prevent part of the glue from remaining attached and accumulating on it.

Upstream of the inlet to the channel 19, along the feed path of the web material N, is a glue dispenser indicated as a whole with 85. It comprises one or more slats 87 rotating around an axis 89, parallel to the axis of rotation of the winding roller 1, 3, 5. At the end of the rod or of each rod 87 is an absorbent pad 88, which is soaked with glue, picked up from a glue applicator 91 analogous to the applicator 47. The dispenser 85 makes one turn for each winding cycle, that is for each log L produced by the machine. It is disposed so that the pads 88 touch the web material N fed around the winding roller 1 to leave on it a quantity of glue sufficient to make the free edge of the web material adhere to the completed log. In the moment of reciprocal contact, the web material N and the pads 88 have the same speed, so as to avoid any damage to the web material N.

In this embodiment the glue dispenser 85 is in an area with ample space available and not provided with a rolling surface for the core. It is therefore possible to design the glue dispenser in other ways to allow the use of a non-liquid glue. For example, the glue may be composed of a double-sided adhesive strip, and the glue dispenser may have a system for unwinding lengths of double-sided adhesive tape and applying them to the web material.

Operation of the machine in this embodiment is clearly shown in the sequence in Figures 8 to 11. In Figure 8 the log L1 has been practically completed and the subsequent winding core A2 destined to form the subsequent log, equipped with glue C, has been partially raised from the hopper 81 by the pusher 83. It is positioned in front of the inlet of the channel 19 but has not yet been brought into contact with the web material N and with the surface 15.

The dispenser 85 is rotating clockwise according to the arrow f85, so that the pads 88 come into contact with the web material N, moving at the same speed as it, to deposit a band of glue on it. This is applied downstream of a perforation line, produced by the perforator 13 and indicated with P, along which the web material will be torn.

The roller 5 is temporarily accelerated so as to tension the web material N. This acceleration commences at a suitable moment, if necessary before the new core A2 is fed to facilitate tearing of the web material, which takes place as described hereunder.

In Figure 9 the glue dispenser 85 is no longer in contact with the web material N while the winding core A2 has been fed into the channel between the rolling surface 15 and the winding roller 1, so that the web material N is pinched between the core A2 and the roller 1. The core A2 starts to roll along the surface 15, while acceleration of the winding roller 5 increases the tension of the web material between the contact point of the roller with the log formed L1 and the point in which the web material is pinched by the new tubular winding core A2. Acceleration of the roller 5 is controlled so that it causes the web material to tear along the perforation P when this is between the core A2 and the log L1, as shown in the position in Figure 10. The final free edge Lf that is produced is provided with the band of glue C2 applied by

the dispenser 85. It continues to wind around the finished log L1, which is moved away by rolling on the surface 45, causing adhesion of the free edge Lf and consequently sealing the log L1. The initial free edge Li remains fastened to the new winding core A2 due to the glue C applied to it. The core A2 continues to roll on the surface 15 until it reaches the nip 6 and subsequently the winding cradle defined by the rollers 1, 3 and 5 where formation of a new log L2 is completed, as shown in Figure 11. This figure also shows a subsequent winding core A3 positioned in the hopper 81 to be fed to the machine by the feeder 83 during the subsequent exchange cycle.

The embodiment in Figures 8 to 11 makes it possible to apply a continuous line of glue both to the cores and to the web material.

Figures 12 to 15 show yet another embodiment of the invention. Equal numbers indicate equal or corresponding parts to those in the embodiment in Figures 1 to 4.

Also in this case the rewinding machine, indicated once again as a whole with 2, comprises a first winding roller 1, rotating around an axis 1A, a second winding roller 3, rotating around a second axis 3A parallel to the axis 1A, and a third winding roller 5, rotating around an axis 5A parallel to the axes 1A and 3A and moving around an axis 7 of oscillation, around which oscillating arms 9 to support the winding roller 5 are supported. The three winding rollers 1, 3 and 5 define a winding cradle 11 inside which, in the position shown in Figure 12, a first log L1 of web material is found in the final phase of winding.

A nip 6 is defined between the winding rollers 1 and 3 through which the web material N passes and is wound around to form the log L1. The web material N is fed around the first winding roller 1 and, before reaching it, through a perforator unit 13 that perforates the web material N along the perforation lines equidistant and substantially orthogonal to the direction of feed of the web material. In this way the web material N wound on the log L1 is divided into sheets that can be separated individually by being torn by the final user.

A rolling surface 15, essentially concave cylindrical and coaxial to the winding roller 1, extends around a portion of said winding roller 1. The rolling surface 15 is formed by a series of parallel strips 17, which terminate with a

narrow portion that extends into annular channels 3B of the second winding roller 3.

The rolling surface 15 forms, with the external cylindrical surface of the winding roller 1, a channel 19 to feed the tubular winding cores. The channel 19 extends from an inlet area 21 to the nip 6 between the winding rollers 1 and 3. It has a height, in a radial direction, equal to or slightly smaller than the diameter of the tubular winding cores. In practice, as specified with reference to the first embodiment, the height of the channel may be variable and increasing from the inlet towards the outlet. In practice, however, the length of the rolling surface 15 and thereby of the channel formed by it with the winding roller 1 may be smaller than shown in the appended figures, as this embodiment does not include a severing element for the web material that must operate along the extension of the channel.

The tubular winding cores are brought in proximity to the inlet 21 of the channel 19 by a conveyor 23 comprising two or more flexible elements parallel with each other and provided with pushers 25. Disposed along the path of the cores A1-A4 conveyed by the conveyor 23 is a glue dispenser, indicated as a whole with 29, of a per se known type, which applies a longitudinal band of glue, continuous or broken, indicated with C, to each of the tubular cores passing over it. This band may be broken in positions corresponding to the positions in which the strips 17, forming the rolling surface 15, are disposed.

In the position in Figure 12, the log L1 formed around the tubular core A1 is in the completion phase in the winding cradle 11. A new winding core A2 is ready to be fed into the channel 19, in front of the inlet 21. The core A2 is contained in a feeder 101 equipped with a seat 101A to hold the winding cores and rotating around an axis 103 parallel to the axis 1A of the winding roller 1. The feeder 101 has a comb structure so as to penetrate, in its rotatory movement around the axis 103, between the strips 17 forming the rolling surface 15, for the purposes explained hereunder. The individual winding cores are unloaded in the seat 101A of the feeder by the conveyor 23.

In front of the seat 101A the feeder is provided with a series of pads 105 soaked in glue, which in the rotatory movement of the feeder 101 come to touch the web material N fed around the winding roller 1 to apply the glue destined to seal the final free edge of the completed log to it. The glue is ap-

plied to the pads 105 by a glue applicator 107 analogous to the one described with reference to Figures 5 to 7. The contact pressure of the pads 105 on the web material is minimum and their relative speed in respect of the web material is null, as it is not the duty of these pads to break or sever the web material N.

Operation of the machine is clearly shown in the sequence in Figures 12 to 15. In Figure 12 the feeder 101 is rotating around the axis 103 at a peripheral speed that makes the pads 105 move at the same speed as the web material N and therefore at the same peripheral speed as the winding roller. The winding roller 5 may already be accelerating or may be accelerated at a slightly later moment, to start the operation to unload the log L1 and to tension the web material N prior to severing. In the example shown, acceleration of the roller 5 has already commenced, and the log L1 has already been moved slightly away from the surface of the winding roller 1, with which it was in contact in the previous winding phase. Detachment of the log L1 from the roller 1 may also take place through the effect of deceleration of the lower roller 3, or through the combined effect of acceleration of the roller 5 and deceleration of the roller 3.

In Figure 13 the feeder 101 has brought the core A2 inside the channel 19, in contact between the web material N and the rolling surface 15. The movement of the feeder 101 is controlled suitably so as not to obstruct the movement to feed the tubular core, which starts to roll on the surface 15 when it comes into contact with it and with the web material N fed around the winding roller 1.

The longitudinal band of glue C2 applied by the pads 105 is positioned on a portion of web material downstream of the contact point with the core A2. As the pads are discontinuous, the band C2 will be broken along its longitudinal extension. The web material between the completed log L1 and the new core A2 is tensioned gradually due to acceleration of the winding roller 5.

The tension produced in the web material N at a certain point causes the material to tear along a perforation line between the core A2 and the log L1, producing a final free edge Lf of the log and an initial free edge Li that will be glued to the new core A2 by means of the glue C. This condition is shown

in Figure 14, wherein the log L1 has moved further from the winding cradle 11 and is about to be unloaded onto the unloading surface 45. The new core A2 is rolling along the rolling surface 15 and the glue C has come into contact with the web material N which adheres to it in proximity to the initial free edge Li produced by tearing. The feeder 101 continues to rotate clockwise, to bring the pads 105 in contact with the gluing roller of the glue applicator 107 below. The feeder 101 continues to rotate until it has been brought to the stand-by position in Figure 15. The time available for this movement is slightly less than the time required to complete the log, and therefore may be relatively slow.

Figure 15 shows the machine in a subsequent phase wherein the new core A2 is in the winding cradle 11 and the new log L2 has started to form around it. A subsequent winding core A3 has in the meantime been unloaded into the seat 101A of the feeder, to be fed to the machine during the next exchange cycle, when the log L2 has been completed.

In a different development of the inventive concept, the core is utilized as a mechanical element to transfer the glue. Figures 16 to 20 show an example of this development. In practice, a rewinding machine is provided to produce logs of wound web material, comprising:

- winding elements to wind the web material and form said logs;
- a severing element to sever the web material upon termination of winding each log, to form a final edge of the finished log and an initial edge of a subsequent log;
- a feeder to feed tubular winding cores towards said winding elements;
- at least a first glue dispenser to apply a first glue to said winding cores, according to at least a longitudinal band,
- said feeder and said severing element being arranged and controlled so that upon termination of winding each log, the web material is severed and said longitudinal band of glue applied to said core is brought into contact with said web material after it has been severed, so that at least part of the glue is transferred to the web material in the vicinity of the final free edge of the finished log, said first glue gluing the final free edge of the log.

With this rewinding machine it is possible to implement a method to produce rolls of wound web material, comprising the phases of:

- winding a quantity of web material around a first winding core to form a first log in a winding area;
- upon termination of winding said first log, severing the web material to produce a final edge of the first log and an initial edge to form a second log;
- applying a first glue to a second winding core, said glue being applied according to at least a longitudinal band essentially parallel to the axis of said core;
- after severing of said web material, bringing said longitudinal band of glue applied to the second core into contact with said web material;
- transferring at least part of the first glue from said core to said web material, in proximity or at the level of said final free edge, to close the final free edge of the first log.

Having thus defined the general concepts underlying this layout, a practical embodiment is described with reference to Figures 16 to 20 and in particular with initial reference to Figure 16. The rewinding machine, indicated as a whole with 2, comprises a first winding roller 1, rotating around an axis 1A, and a second winding roller 3, rotating around a second axis 3A parallel to the axis 1A. A third winding roller 5, rotating around an axis 5A parallel to the axes 1A and 3A is also provided. The third winding roller 5 is supported by oscillating arms 9.

The three winding rollers 1, 3 and 5 form a winding cradle. A nip 6 is defined between the rollers 1 and 3, fed through which is the web material N to be wound, which is fed around the winding roller 1. In the condition in Figure 16, a first log L1 of web material is found in the winding cradle 1, 3, 5 in the winding phase, and the three winding rollers rotate substantially at the same peripheral speed, equivalent to the feed speed of the web material N. The log L1 is being wound around a first winding core A1.

Upstream of the winding roller 1 the web material passes through a perforator, not shown, which forms crosswise perforation lines along the material N.

A rolling surface 15, substantially concave cylindrical and essentially coaxial to the winding roller 1, extends around said winding roller 1. It is formed by a series of strips 17 parallel to and spaced apart from one another,

one of which is shown in the figure and the others are parallel to it. The strips 17 terminate with a narrow portion that extends into annular channels 3B of the second winding roller 3. The layout is analogous to the one described in WO-A-9421545, the content of which may be referred to for greater details concerning the construction of this rolling surfaces.

The rolling surface 15 forms, with the external cylindrical surface of the winding roller 1, a channel 19 to feed the tubular winding cores. The channel 19 extends from an inlet area 21 to the nip 6 between the winding rollers 1 and 3. It has a height, in a radial direction, equal to or slightly less than the diameter of the tubular winding cores, which must be sequentially fed into the winding area in the manner described below. In practice, the channel may increase gradually in height from the inlet to the outlet, to facilitate the increase in the diameter of the log in the first winding phase, when the first turns of web material are wound around the tubular core that rolls in the channel. For example, the height of the channel may be slightly below the diameter of the winding core at the inlet of the channel and slightly above it at the level of the outlet.

The tubular winding cores are carried to the inlet 21 of the channel 19 by a conveyor 23 comprising two or more flexible elements parallel with one another and equipped with pushers 25 that pick up each single tubular winding core A (A1, A2, A3, A4) from a hopper or other container 26. Disposed along the path of the cores A1-A4 carried by the conveyor 23 is a glue dispenser, indicated as a whole with 29, of a per se known type, which applies a longitudinal band of glue, continuous or broken, to each of the tubular cores traveling over it, that is parallel to the axis of said cores. It must be understood that other conveying and gluing systems may be used to convey the tubular winding cores and to apply glue to them, preferably along longitudinal lines, that is parallel to the axis of said cores. In the example shown, the glue dispenser includes a tank 28 inside which the glue C is contained and inside which a moving element 34A is immerged. In the example shown the element 34A is provided with an alternate movement of immersion as it is connected to an oscillating arm 32A. Other systems may also be used to transfer glue from the tank to the core that is positioned over the tank each time. In general, the dispenser is in any case suitable to apply a longitudinal band of

glue. Figure 16 also shows with a dashed line a second glue dispensing element, specular to the first, capable of applying a second band of glue to the core for the purposes described below. The two longitudinal bands of glue may also be applied by two separate dispensers that use different glues, also in view of the different technical properties the glue must have, one being destined to close the final free edge of the logs formed and the other to make the initial free edge of the web material adhere to the new core.

Disposed along the path of the conveyor 23 is a system that causes the glued cores to rotate around their axis by a determined angle. In the example schematically illustrated this is a belt 36 provided with a movement according to the arrow in the figure. This allows the glued cores to arrive at the inlet 21 of the channel 19 with the band or bands of glue in the desired position.

In the layout in Figure 16 the tubular winding cores A2 and A3 have already been equipped with a longitudinal band of glue, indicated with C. This band may be broken in positions corresponding to the positions in which the strips 17 and the pushers 25, with the respective chains carrying them, are disposed.

The tubular winding core A2 is in proximity to the inlet 21 of the channel, into which it is subsequently fed by an auxiliary feeder 30 of a per se known type (see for example WO-A-9421545) or in any other suitable way, for example by a sudden movement of the conveyor 23 and through the effect of the thrust of the pusher 25. The auxiliary feeder 30 may be constituted with a comb structure to penetrate between the strips 17. The longitudinal band of glue C may also be broken at the level of the teeth forming the structure of the auxiliary feeder 30.

Disposed upstream of the inlet 21 of the channel 19 is a severing element for the web material N, generically indicated with 101. It includes a series of pads 103 carried by an element rotating around an axis 105 by means of an actuator 107, for example an electric motor controlled electronically so that the speed and/or position of the pads 103 may be controlled accurately as a function of the position and/or speed of the remaining elements of the machine.

In the position in Figure 16 the element 101 is in the operating condi-

tion, that is in the position in which tearing or severing of the web material starts or has started. Tearing or severing is obtained thanks to the difference in peripheral speed of the pads 103 in respect of the first winding roller 1 and in respect of the web material N fed around it. Normally, in this phase the pads 103 rotate at a speed slightly below the peripheral speed of the roller 1 and therefore below the normal feed speed of the web material N. This causes tensioning and tearing of the material N along the perforation line located immediately downstream of the area in which the web material N is pinched by the pads 103 against the winding roller 1. Figure 16 already shows severing of the web material, with consequent forming of a final or tail edge Lf of the material, destined to be wound around the log L1 in the completion phase in the winding cradle, and an initial or leading edge Li destined to adhere to the new core A2 that will be fed into the channel 19.

In this case, feed of the core A2 is delayed in respect of tearing the web material, as can be seen from the sequence in the subsequent Figures 17 to 20. It must, however, be pointed out that the moment in time in which the core is fed may differ. What is relevant is that core insertion and the angular position of the core are timed so that the glue is applied to a portion of the web material downstream of the final free edge of the completed log. In practice, the core A2 is fed into the inlet 21 of the channel 19 and therefore in contact with the web material N fed around the roller 1 after tearing or severing of the web material has already taken place. Figure 17 shows the moment in which the core comes into contact with the web material N. As it is forced into the channel 19, it starts to roll on the surface 15 of the channel 19 and moves forward along said channel, undergoing angular acceleration.

In practice, the core may also be fed into the inlet 21 and therefore be brought into contact with the web material N before the moment in which the web material is torn or severed. However, contact between the longitudinal band of glue C and the web material N takes place after tearing of the web material and forming of the edges Li and Lf.

The angular position of the core A2 is regulated so that it preferably comes into contact with the web material N and therefore starts to accelerate angularly rolling on the surface 15 before the band of glue C comes into contact with the web material. This allows contact between the web material N

and the glue C at a moment in which there is practically no difference in speed between these two elements, thereby guaranteeing optimal transfer of glue. In fact, at least part of the glue C is in this phase transferred from the core A2 to the web material N in proximity or adjacent to the final free edge Lf. This quantity of glue guarantees subsequent closing by gluing the final free edge on the finished log L1.

In Figure 18 the core A2 has already traveled part of its path along the channel 19. In respect of the position in the previous Figure 17, it is turned through more or less 360°, so that the band of glue C is back in the original position of Figure 17 and, the moment subsequent to this, said band of glue comes into contact with the initial free edge Li of the web material. This guarantees adhesion of said edge to the new core and allows winding of the subsequent log L2 to commence. Figures 19 and 20 show the moments subsequent to transfer of the core A2 to the winding cradle and forming of the log L2. In the meantime the previously formed log L1 has been unloaded from the winding cradle in a per se known way.

To guarantee control of the leading and tail edges Li and Lf of the web material, which is severed upstream of the area of contact with the new core A2, this embodiment provides a holding system on the surface of the winding roller 1 which maintains control of the edges Li and Lf from the area in which they are produced through the effect of the severing element 101 to the area of contact with the core. In this example, the edges Lf and Li are held pneumatically. The winding roller 1 is equipped with a cylindrical sleeve at least partly perforated. A fixed suction chamber 111 is provided inside the roller 1, extending for an arc of more or less 180° from an area upstream of the point in which the web material N is pinched by the element 101 to an intermediate area along the channel 19. This guarantees hold, by suction through the holes in the cylindrical sleeve of the roller 1, of the edges Li and Lf. Moreover, this prevents excessive slackening of the web material upstream of the element 101 during tearing. Above all, the edge Li is held adhering to the roller 1 at least until the position in which it is pinched between the core A2 and the roller 1. The suction chamber 111 terminates its holding effect when the core and the initial edge Li have reached the position of Figure 18, so that when the holding action on the roller 1 terminates the edge Li can adhere to

the core A2. In this figure, C2 indicates a band of glue transferred from the core A2 to the final edge Lf of the completed log L1.

In practice, adhesion of the web material N to the core may also take place in a position spaced from the final edge of the initial free edge Li, as in any case this area remains wound inside the log to be formed subsequently. Instead, timing of the various elements of the machine must preferably allow the glue to close the log, applied to the final edge Lf to be as close as possible to the end of the final edge Lf, as this remains exposed on the outside of the log. The most advantageous condition is for the band of glue transferred from the core A to the web material N to be around 1 cm from the tearing edge, that is from the perforation line along which the web material is torn. This guarantees optimal closing and at the same time leaves a free edge for the final user to grip the web material and open the roll. Correct angular positioning of the core during feed into the channel 19 guarantees these optimal operating conditions.

It is understood that the drawing merely shows an example provided purely as a practical embodiment of the invention, which may vary in shapes and arrangements without however departing from the scope of the concept on which the invention is based. Any reference numbers in the appended claims are provided to facilitate reading of the claims with reference to the description and the drawing, and do not limit the scope of protection represented by the claims.

CLAIMS

1. A rewinding machine for producing logs (L1, L2) of wound web material (N), comprising:

- winding elements to wind the web material and form said logs;
- means to sever the web material upon termination of winding each log (L1, L2);
- at least a first glue dispenser (31; 31B; 85; 105) to apply a first glue (C2) to a portion of said web material, in proximity to a severing line, along which the web material is severed upon termination of winding a log to form a final free edge and an initial free edge, said first glue gluing the final free edge of the log;

characterized in that said first glue dispenser comprises a mechanical element (31; 31B; 87; 105) that touches the web material at the end of winding of each log (L1, L2), to transfer said first glue to said web material (N).

2. Rewinding machine as claimed in claim 1, characterized in that it is a peripheral winding machine comprising a winding cradle (11) with at least a first winding element (1) around which said web material (N) is fed.

3. Rewinding machine as claimed in claim 1 or 2, characterized in that said mechanical element is a rotating element.

4. Rewinding machine as claimed in claim 2 or 3, characterized in that said first glue dispenser applies said first glue to a portion of web material wound around said first winding element (1).

5. Rewinding machine as claimed in one or more of the previous claims, characterized in that said mechanical element has at least one pad (41) suitable to pick up said first glue and to touch said web material, to transfer to it at least part of the glue picked up.

6. Rewinding machine as claimed in at least claim 2, characterized in that it comprises a feeder (30; 83; 101) to feed tubular winding cores (A1, A2, A3, A4; A5), around which said logs are wound, towards said winding cradle.

7. Rewinding machine as claimed in claim 6, characterized in that it comprises a second gluing unit (29) to apply a second glue to said tubular winding cores.

8. Rewinding machine as claimed in claim 6 or 7, characterized in

that said mechanical element (105) is associated with said feeder (101).

9. Rewinding machine as claimed in claim 8, characterized in that said mechanical element is integral with said feeder (101).

10. Rewinding machine as claimed in claim 9, characterized in that said feeder comprises an oscillating or rotating seat (101A), with which said mechanical element (105) is integral.

11. Rewinding machine as claimed in one or more of claims 1 to 7, characterized in that: said means to sever the web material upon termination of winding each log (L1, L2) comprise a rotating severing element (31), co-operating with said first winding element (1); and in that said mechanical element (31; 31B) of the first glue dispenser is associated with said severing element (31).

12. Rewinding machine as claimed in claim 11, characterized in that said severing element (31) and said mechanical element (31; 31B) of the first glue dispenser are integral with each other.

13. Rewinding machine as claimed in claim 11 or 12, characterized in that when said severing element (31) is in contact with said web material it has a peripheral speed differing in respect of said first winding element (1).

14. Rewinding machine as claimed in one or more of claims 1 to 7, characterized in that said mechanical element (31B; 87; 105) of the first glue dispenser is constituted by an element rotating around an axis of rotation (31A; 89; 103) and cooperating with said first winding element (1), the web material being pinched between said first winding element (1) and said rotating element, when said rotating element is in contact with said web material (N) having a peripheral speed different from the peripheral speed of said first winding element (1).

15. Rewinding machine as claimed in at least claim 6, characterized by a rolling surface (15) defining with said first winding element (1) a channel (19) to feed said winding cores (A1-A4); and wherein said winding cores are fed into said channel and made to roll inside it before the web material is severed.

16. Rewinding machine as claimed in one or more of the previous claims, characterized in that said first glue dispenser applies said first glue along longitudinal bands, continuous or broken, on said web material.

17. Rewinding machine as claimed in one or more of the previous claims, characterized in that: in comprises a feeder to feed tubular winding cores towards a winding cradle, around which said logs are wound; in that said mechanical element comprises a winding core, to which a glue has been applied, and around which a log of web material is subsequently wound; and in that said means to sever the web material and said feeder are designed and arranged to cause severing of the web material before said core transfers the glue to said web material to close the final edge; said glue being applied to said core according to at least a longitudinal band.

18. Rewinding machine to produce logs of web material wound on a winding core, comprising:

- winding elements to wind the web material and form said logs;
- a severing element to sever the web material upon termination of winding each log, to form a final edge of the finished log and an initial edge of a subsequent log;
- a feeder to feed tubular winding cores towards said winding elements;
- at least a first glue dispenser to apply a first glue to said winding cores, according to at least a longitudinal band,
- said feeder and said severing element being disposed and controlled so that upon termination of winding each log, the web material is severed and said longitudinal band of glue applied to said core is brought into contact with said web material after it has been severed, so that at least part of said first glue is transferred to the web material in the vicinity of the final free edge of the finished log, to glue the final free edge of the log.

19. Rewinding machine as claimed in claim 18, characterized in that it is a peripheral rewinding machine comprising a winding cradle with at least a first winding element around which said web material is fed.

20. Rewinding machine as claimed in claim 18 or 19, characterized in that the core applies at least a part of said first glue to a portion of web material fed around said first winding element.

21. Rewinding machine as claimed in claims 18, 19 or 20, characterized in that it comprises a second glue dispenser to apply a second glue to said tubular winding cores, to fasten the initial free edge to said cores.

22. Rewinding machine as claimed in one or more of claims 19 to

21, characterized in that: said means to sever the web material upon termination of winding each log comprise a rotating severing element, cooperating with said first winding element.

23. Rewinding machine as claimed in one or more of claims 19 to 22, characterized in that when said severing element is in contact with said web material, it has a peripheral speed differing in respect of the peripheral speed of said first winding element.

24. Rewinding machine as claimed in at least claim 19, characterized by a rolling surface defining with said first winding element a channel with an inlet for inserting said winding cores; and in that said winding cores are fed into said channel and made to roll inside it, to bring said first glue in contact with the web material fed around said winding element.

25. Machine as claimed in claim 24, characterized in that said first winding element has a suction portion, upstream of the inlet of said channel, to hold the initial edge and the final edge on the surface of said winding element, said severing element being disposed to act upstream of said channel.

26. Method for producing logs of wound web material, comprising the phases of:

- winding a quantity of web material (N) to form a first log (L1) in a winding area;
- upon termination of winding said first log (L1), severing the web material to create a final edge (Lf) of the first log and an initial edge (Li) to form a second log;
- applying a first glue to a portion of the web material destined to remain wound on the first log, in proximity to the final free edge, which is glued to the first log upon termination of winding,

characterized in that said first glue is applied to the web material by a mechanical element that comes into contact with said web material.

27. Method as claimed in claim 26, characterized in that said logs are wound around tubular winding cores (A1-A4).

Method as claimed in claim 27, characterized in that a second glue is applied to said tubular winding cores to fasten the initial free edge of the web material.

28. Method as claimed in claim 26, 27 or 28, characterized in that said

mechanical element applies said first glue with a rotatory movement.

29. Method as claimed in claim 28 or 29, characterized in that said first glue is applied by means of a feeder of said tubular cores, during insertion of a core towards said winding area.

30. Method as claimed in one or more of claims 26 to 29, characterized in that said first glue is applied by means of a severing element that also severs the web material upon termination of winding each log.

31. Method as claimed in one or more of claims 26 to 31, characterized in that said first glue is applied along a longitudinal line.

32. Method as claimed in one or more of claims 26 to 32, characterized in that said logs are wound with a peripheral winding system.

33. Method as claimed in one or more of claims 26 to 33, characterized in that said first glue is applied to the web material before severing of the web material.

34. Method as claimed in one or more of claims 26 to 34, characterized in that said first glue is a liquid or semi-liquid glue.

35. Method as claimed in one or more of claims 26 to 35, characterized in that said first glue is a non-liquid glue, such as a strip of double-sided adhesive material.

36. Method as claimed in one or more of claims 26 to 36, characterized by providing a feeder for tubular cores to feed winding cores around which said logs are formed towards a winding cradle; in that said first glue is applied, according to at least an essentially longitudinal band, to said cores and transferred at least partially to the web material, said web material being severed before transfer of the first glue to said web material to close the final edge.

37. Method to produce logs of wound web material, comprising the phases of:

- winding a quantity of web material around a first winding core to form a first log in a winding area;
- upon termination of winding said first log, severing the web material to produce a final edge of the first log and an initial edge to form a second log;
- applying a first glue to a second winding core, said glue being applied

according to at least a longitudinal band essentially parallel to the axis of said core;

- after severing of said web material, bringing said longitudinal band of glue applied to the second core into contact with said web material;
- transferring at least part of the first glue from said core to said web material, in proximity or at the level of said final free edge, to close the final free edge of the first log.

39. Method as claimed in claim 38, wherein said initial edge is made to adhere to said second core by means of said first glue.

40. Method as claimed in claim 38, characterized in that a second glue is applied to said tubular winding cores to fasten the initial free edge of the web material.

41. Method as claimed in one or more of claims 38 to 40, characterized in that said logs are wound with a peripheral winding system comprising at least a first winding element.

42. Method as claimed in one or more of claims 38 to 41, characterized in that said first glue is a liquid or semi-liquid glue.

43. Method as claimed in one or more of claims 38 to 42, characterized by providing a first winding element and a rolling surface defining, with said first winding element, a channel to introduce said cores, with an inlet inside which said cores are fed, and in that said web material is severed upstream of said inlet.

44. Method as claimed in claim 43, characterized in that the final edge and the initial edge of said web material after severing are held on the surface of said winding element through suction, to convey said final edge and said initial edge towards the inlet of said channel.

45. Method as claimed in one or more of claims 38 to 44, characterized in that the web material is severed by pinching said web material between a first winding element around which it is fed and a severing element, moving at a speed differing from the speed of the winding element.

Fig.1

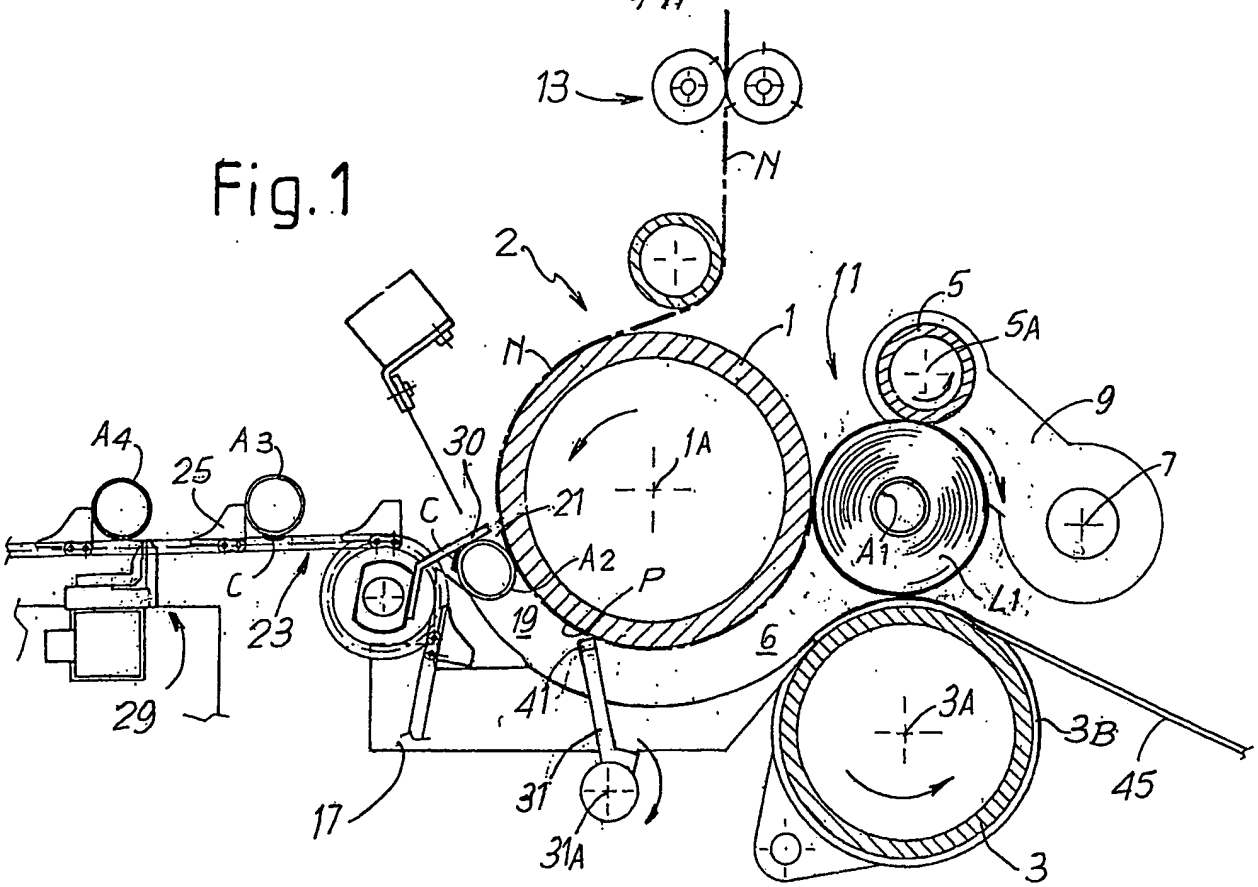

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Fig.2

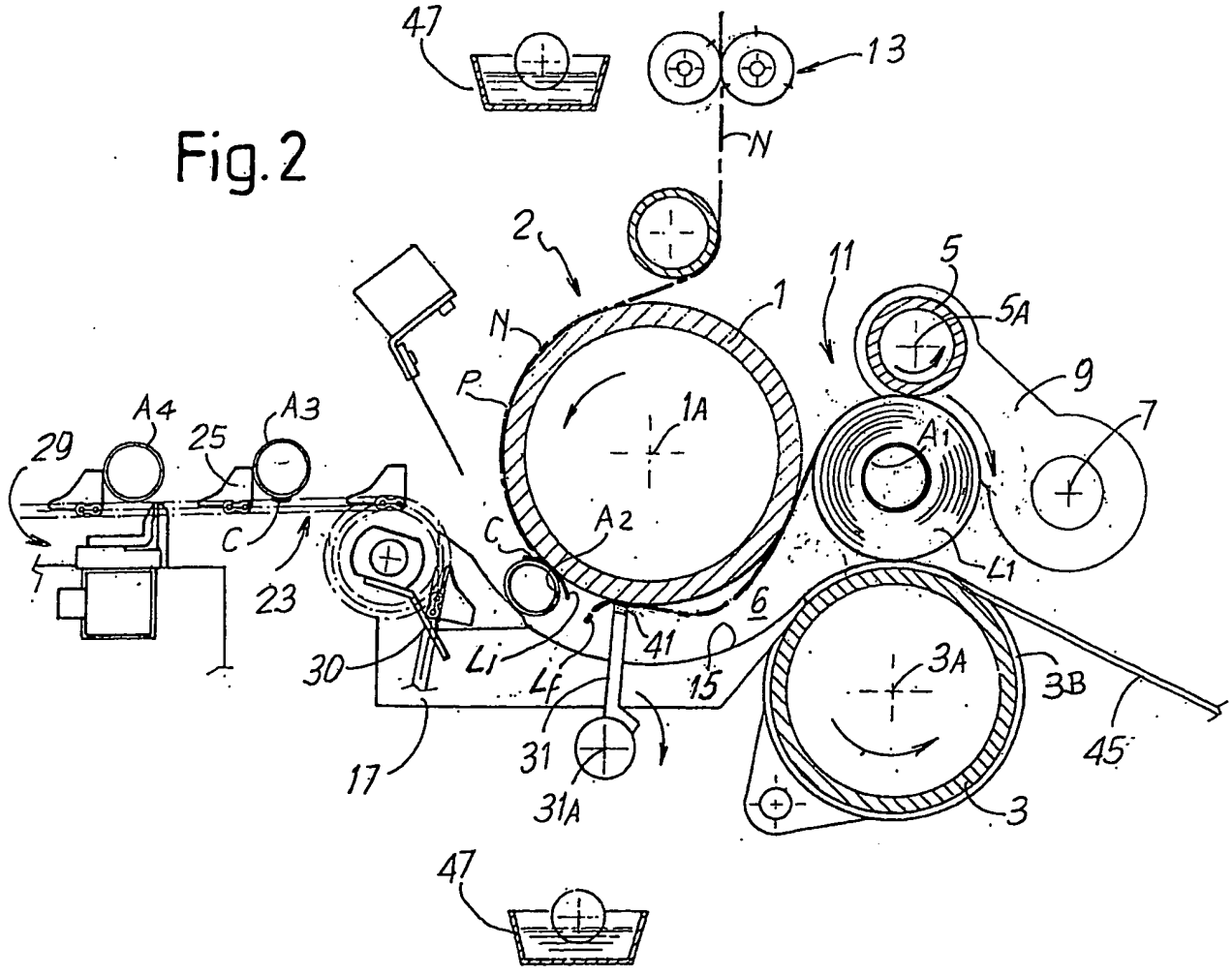
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Fig.3

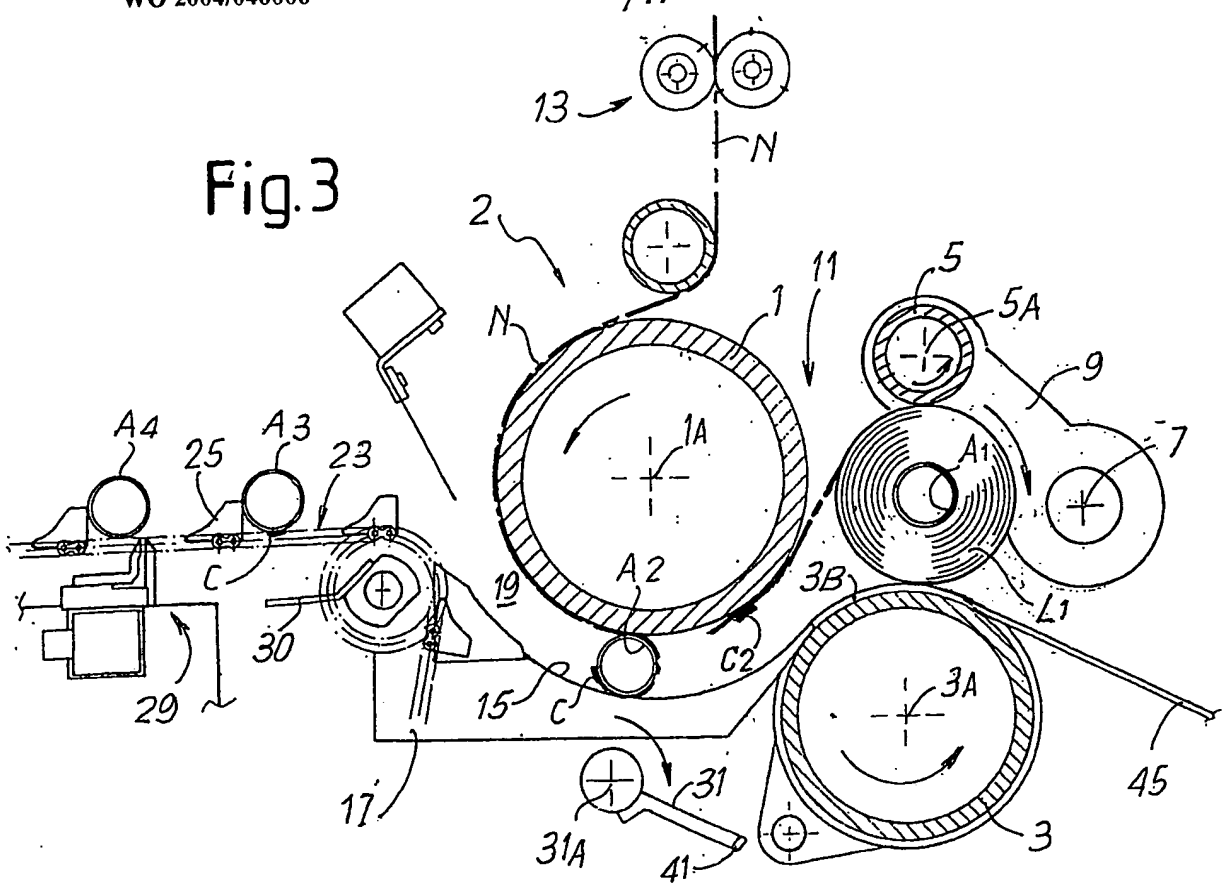
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Fig.4

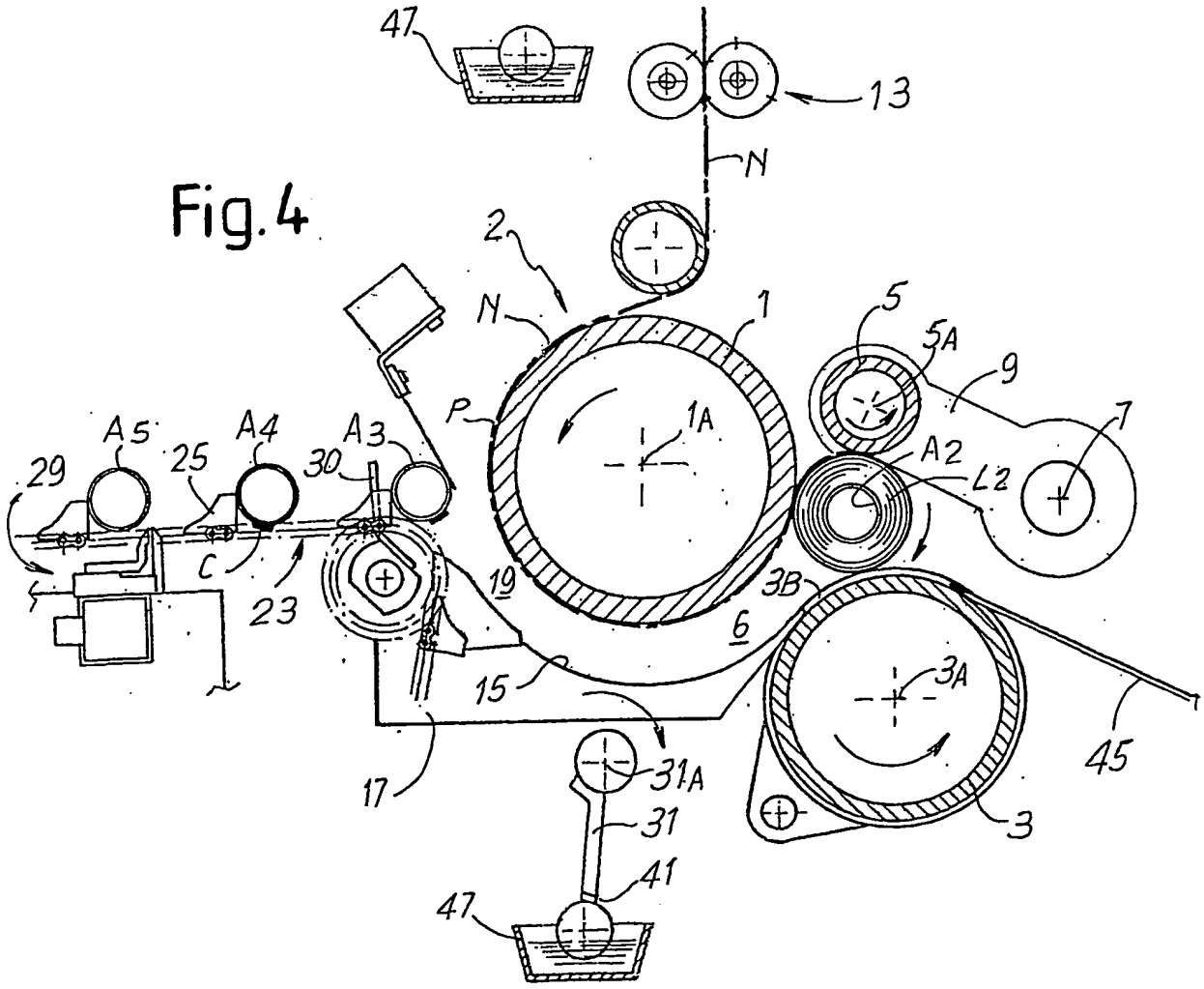
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Fig.5

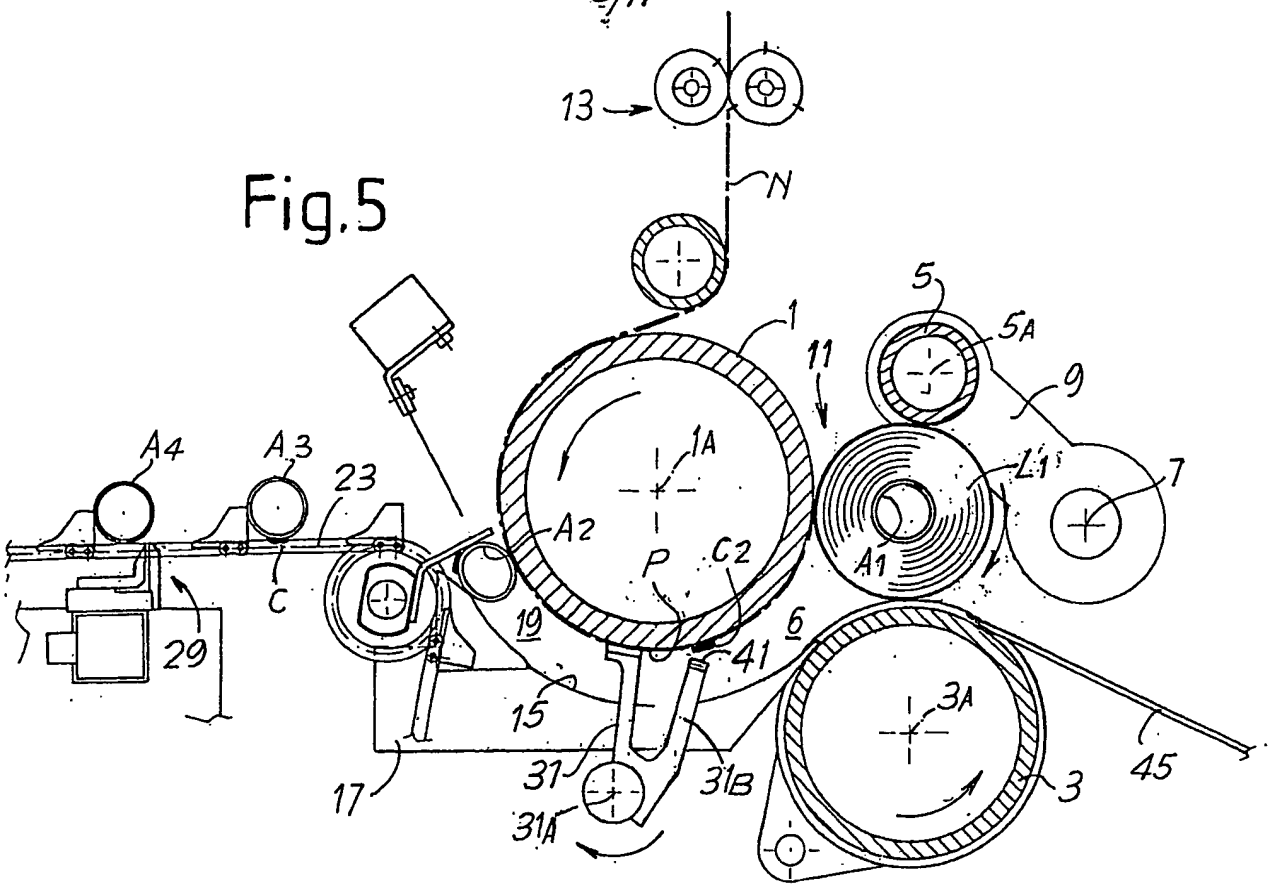
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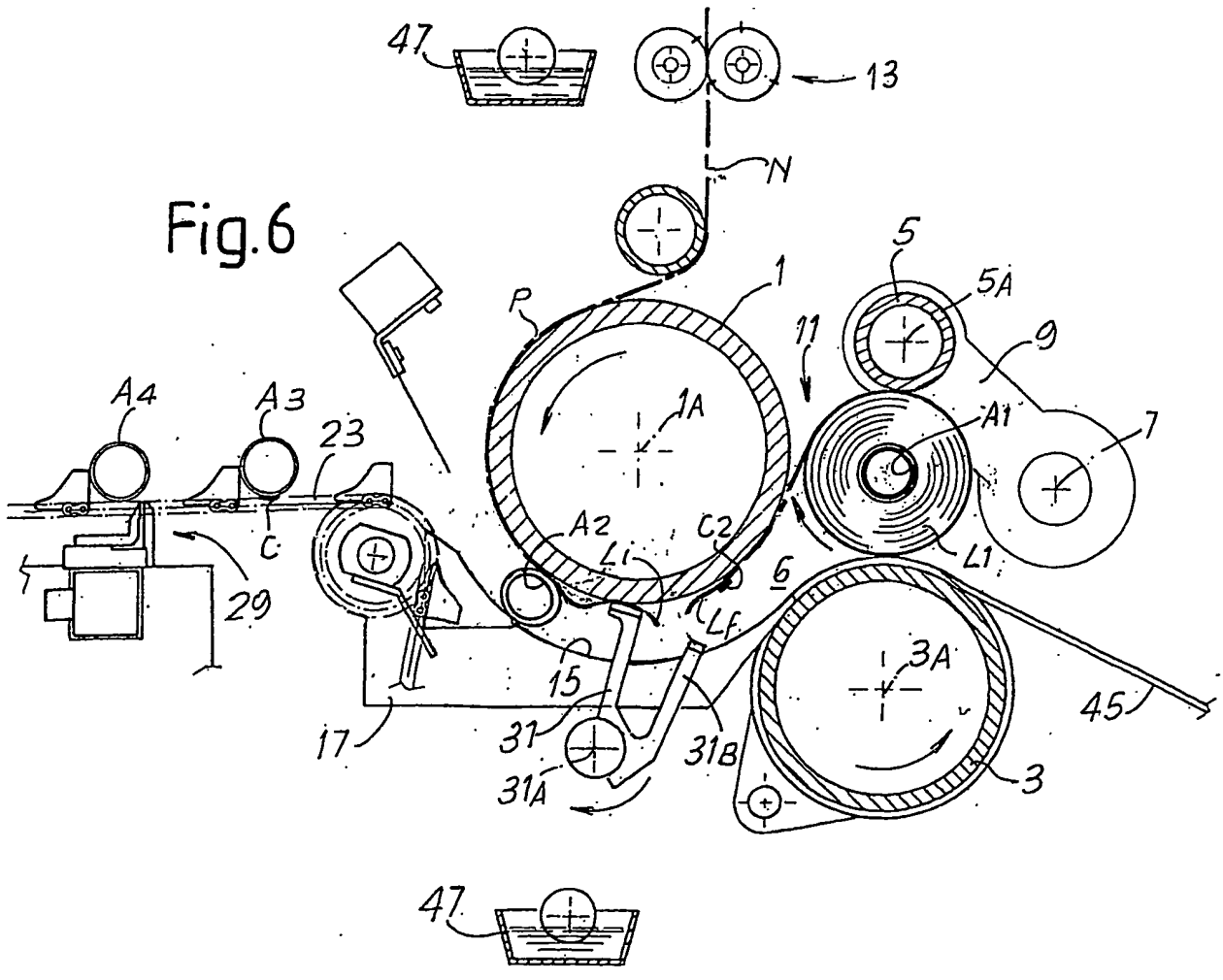
Fig.6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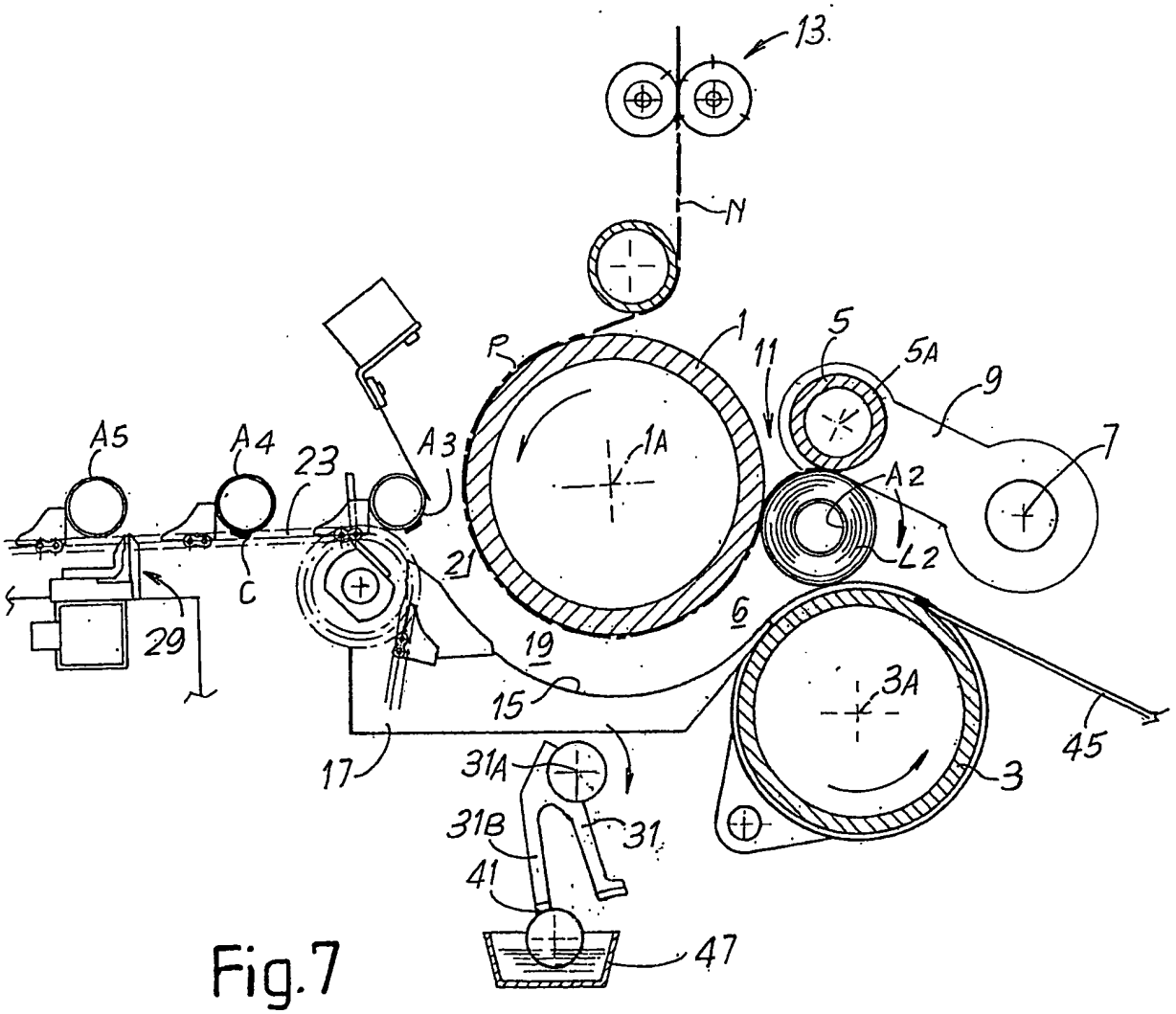
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Fig.7

Fig.8

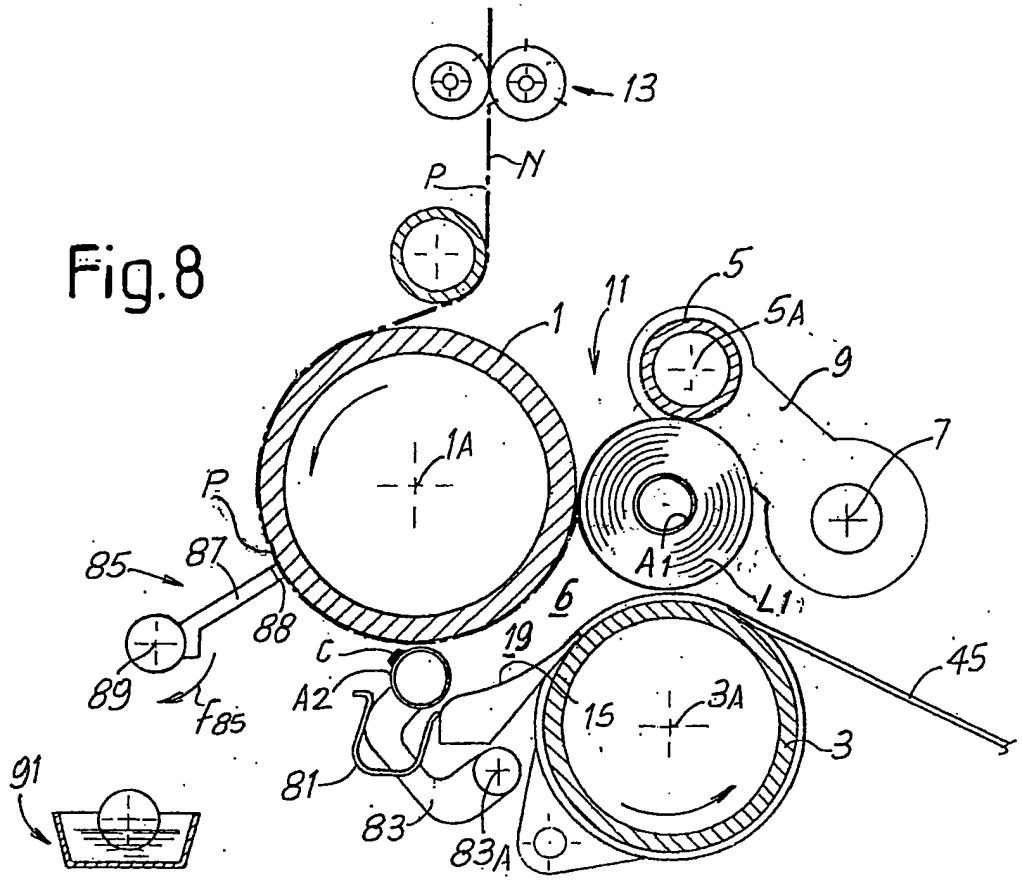
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Fig.9

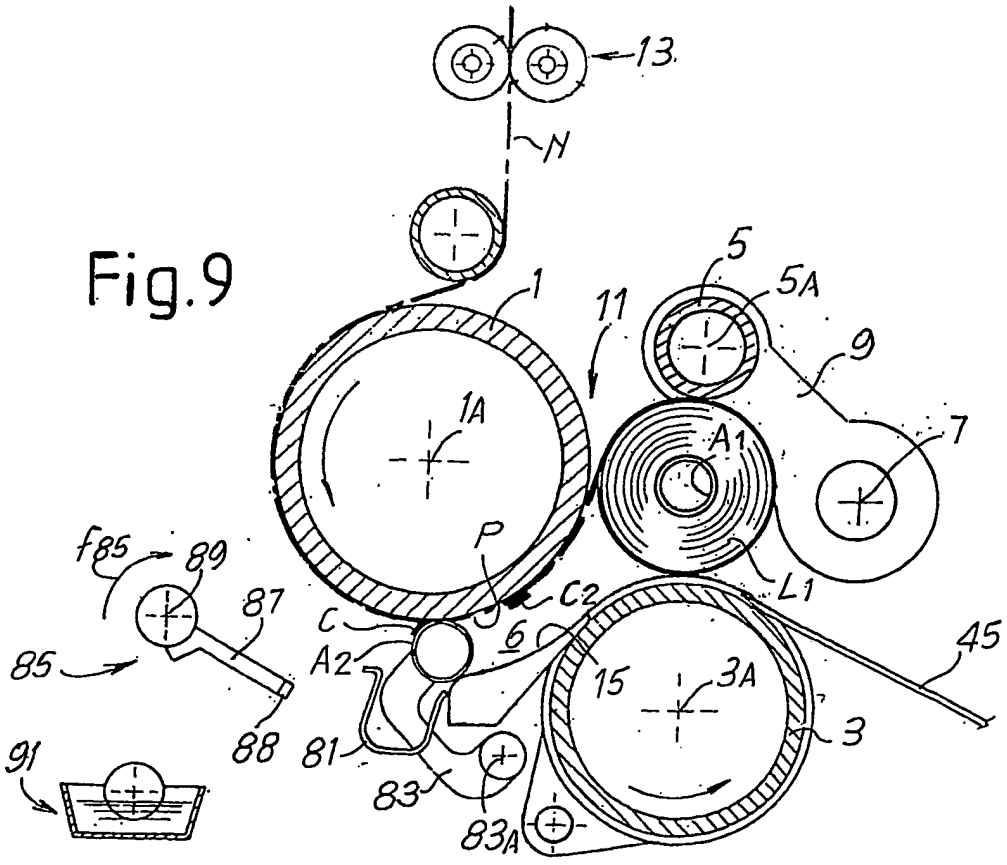
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Fig.10

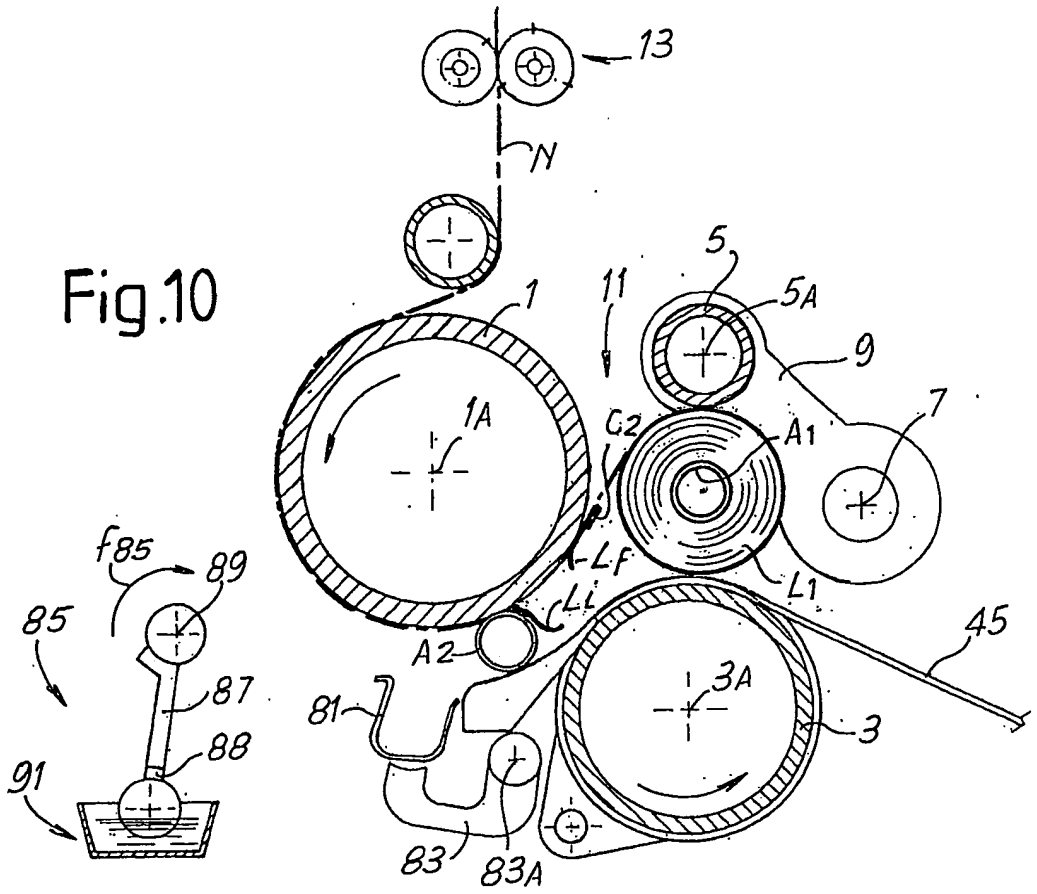
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Fig.11

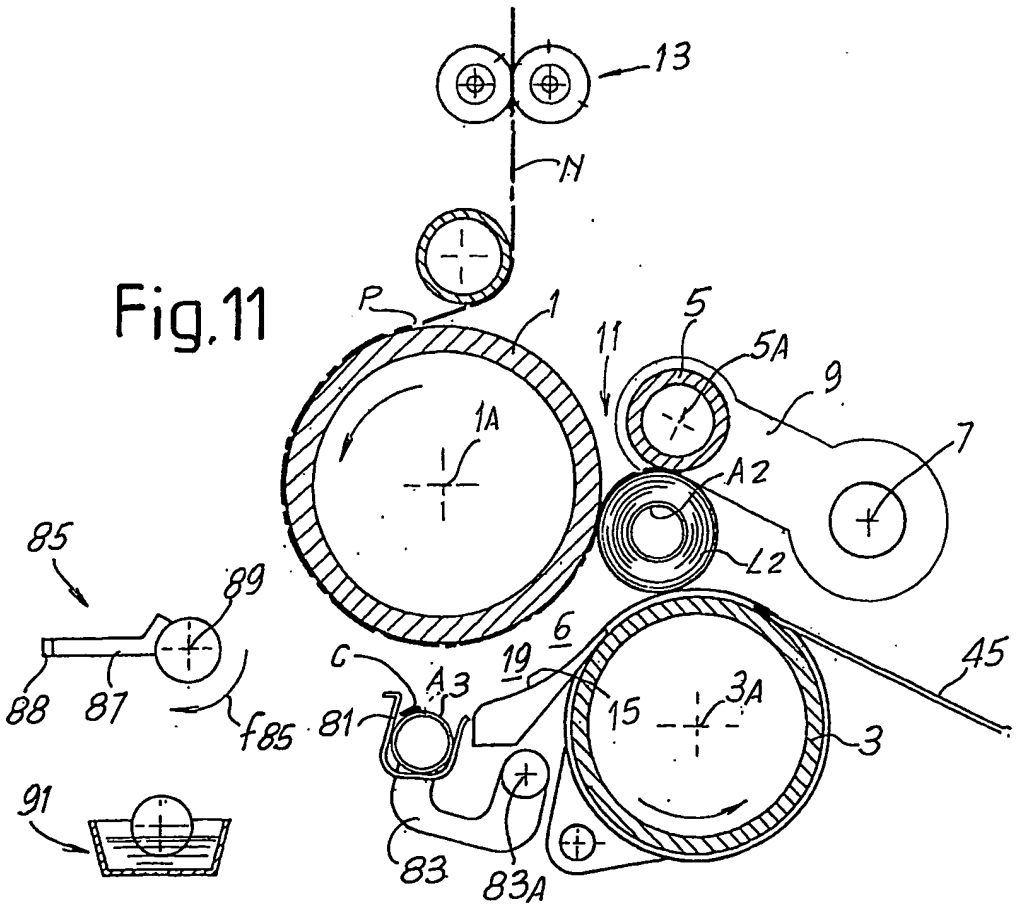
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Fig.12

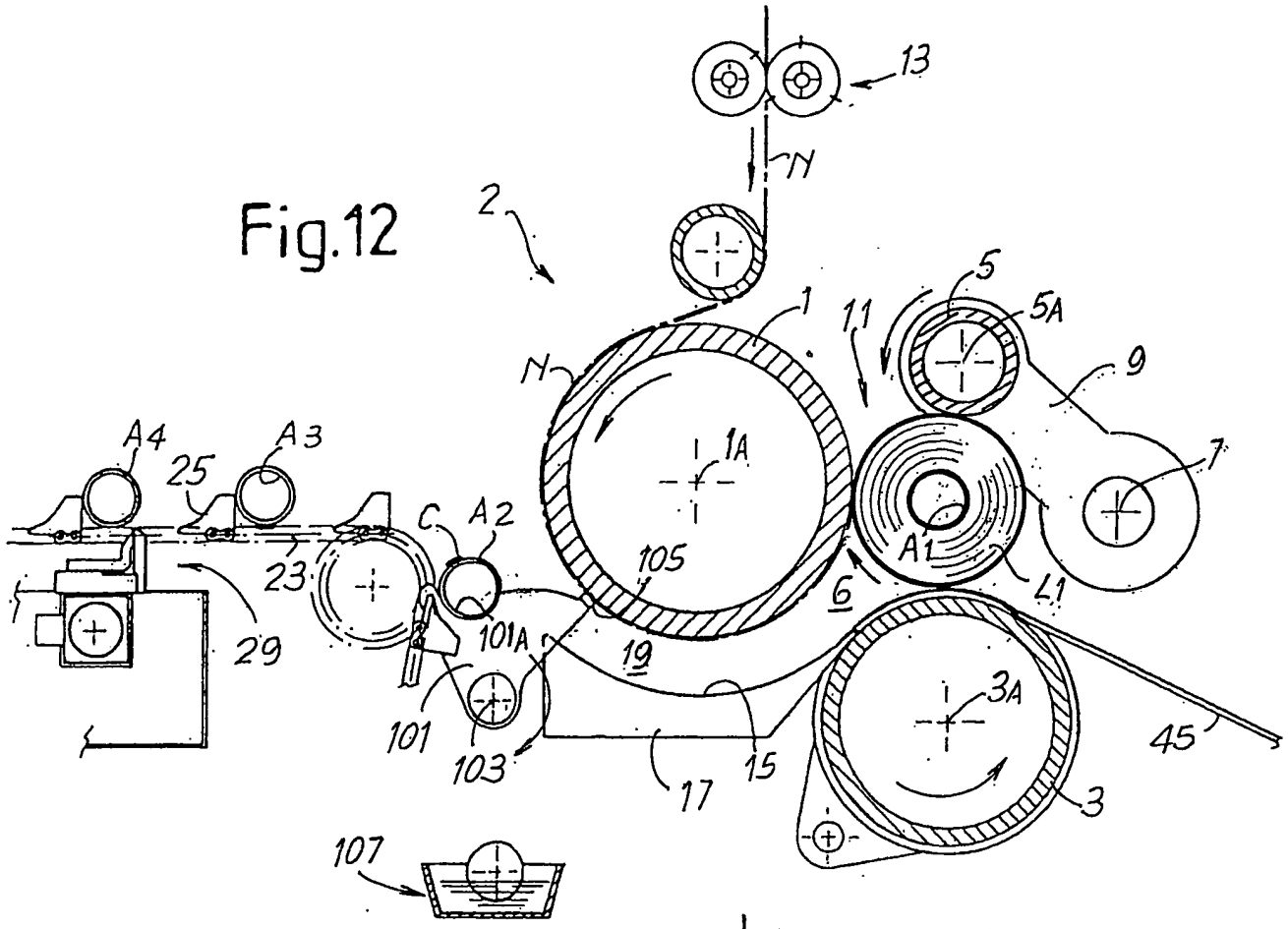
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Fig.13

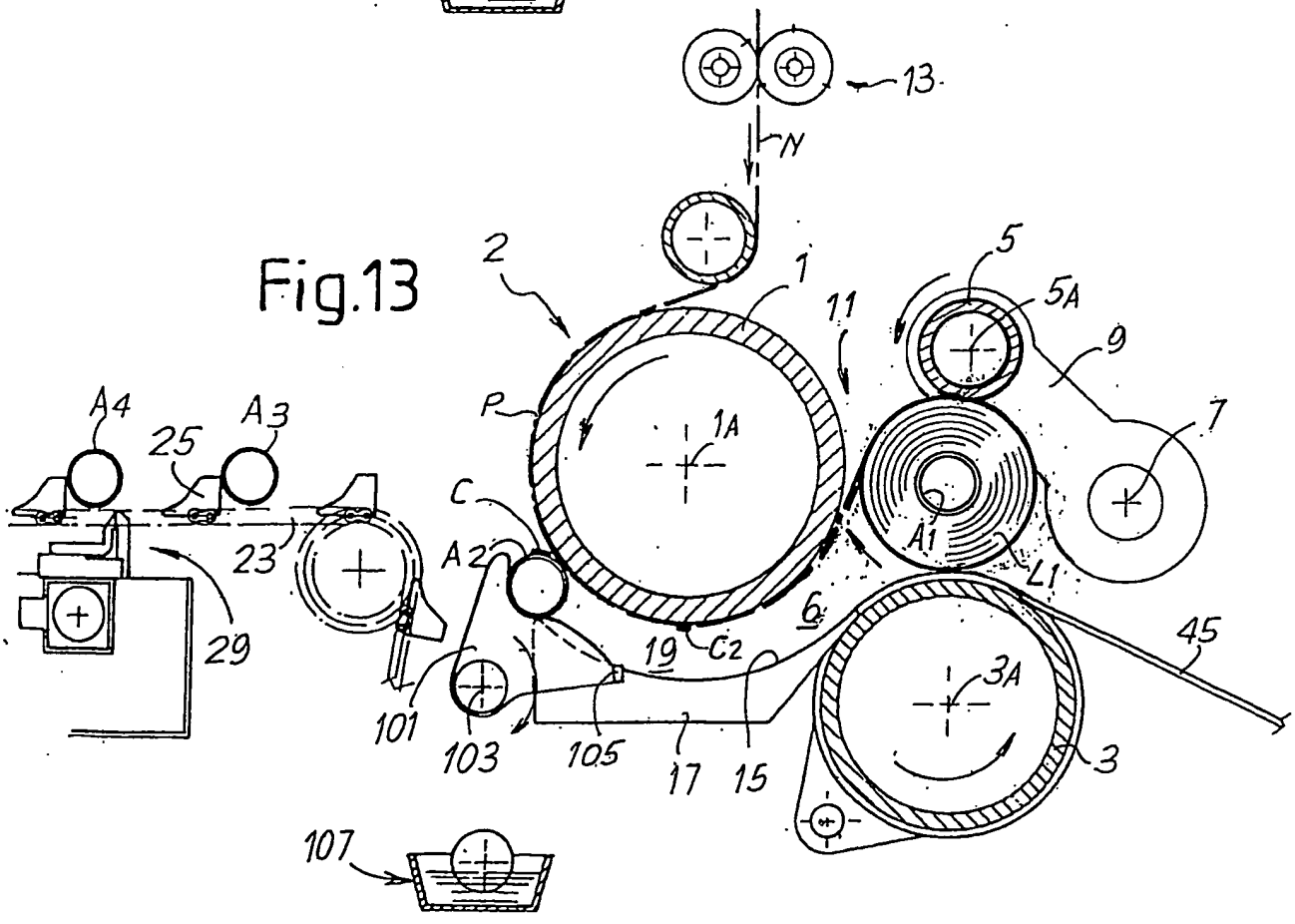
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Fig.14

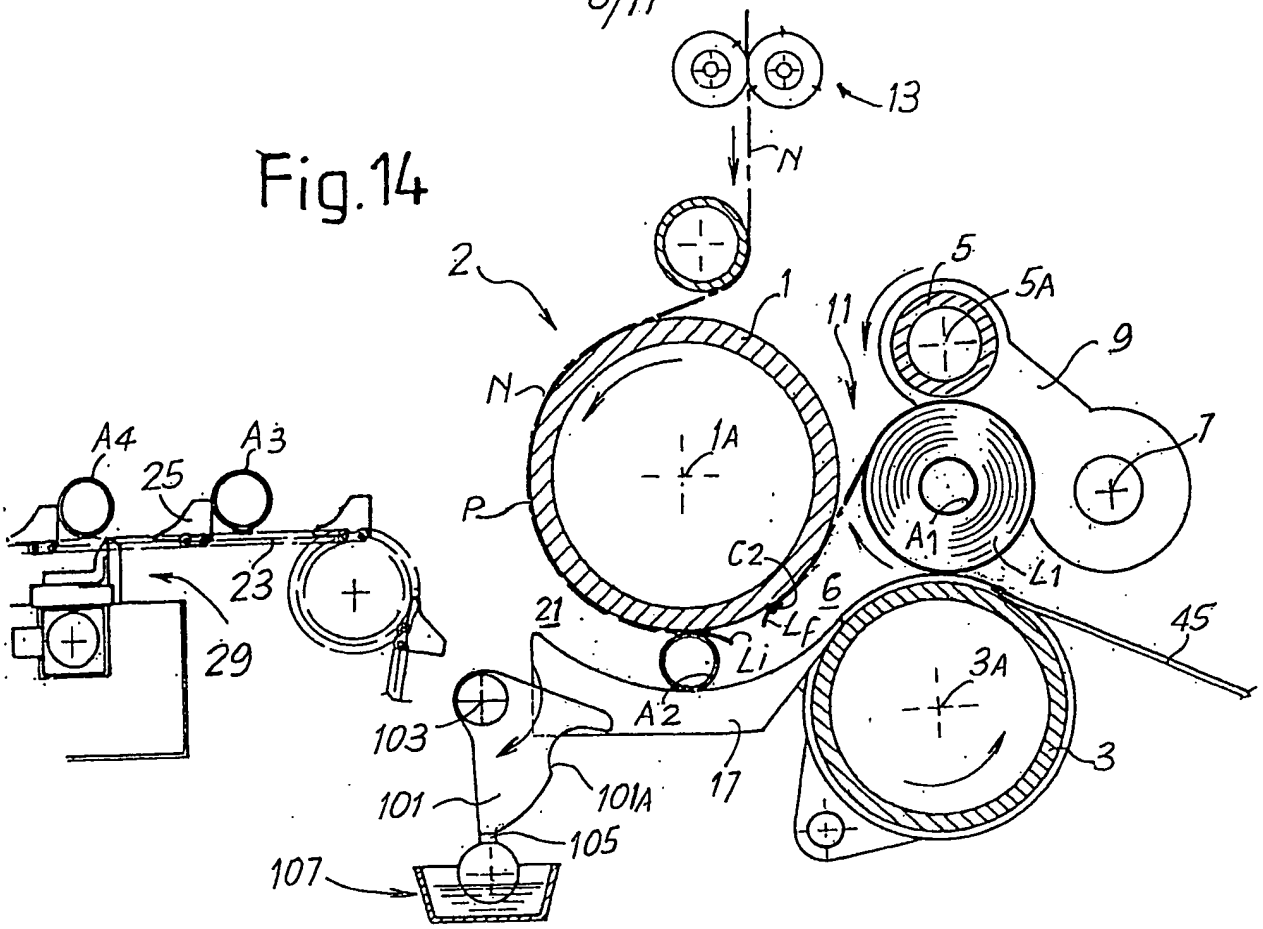
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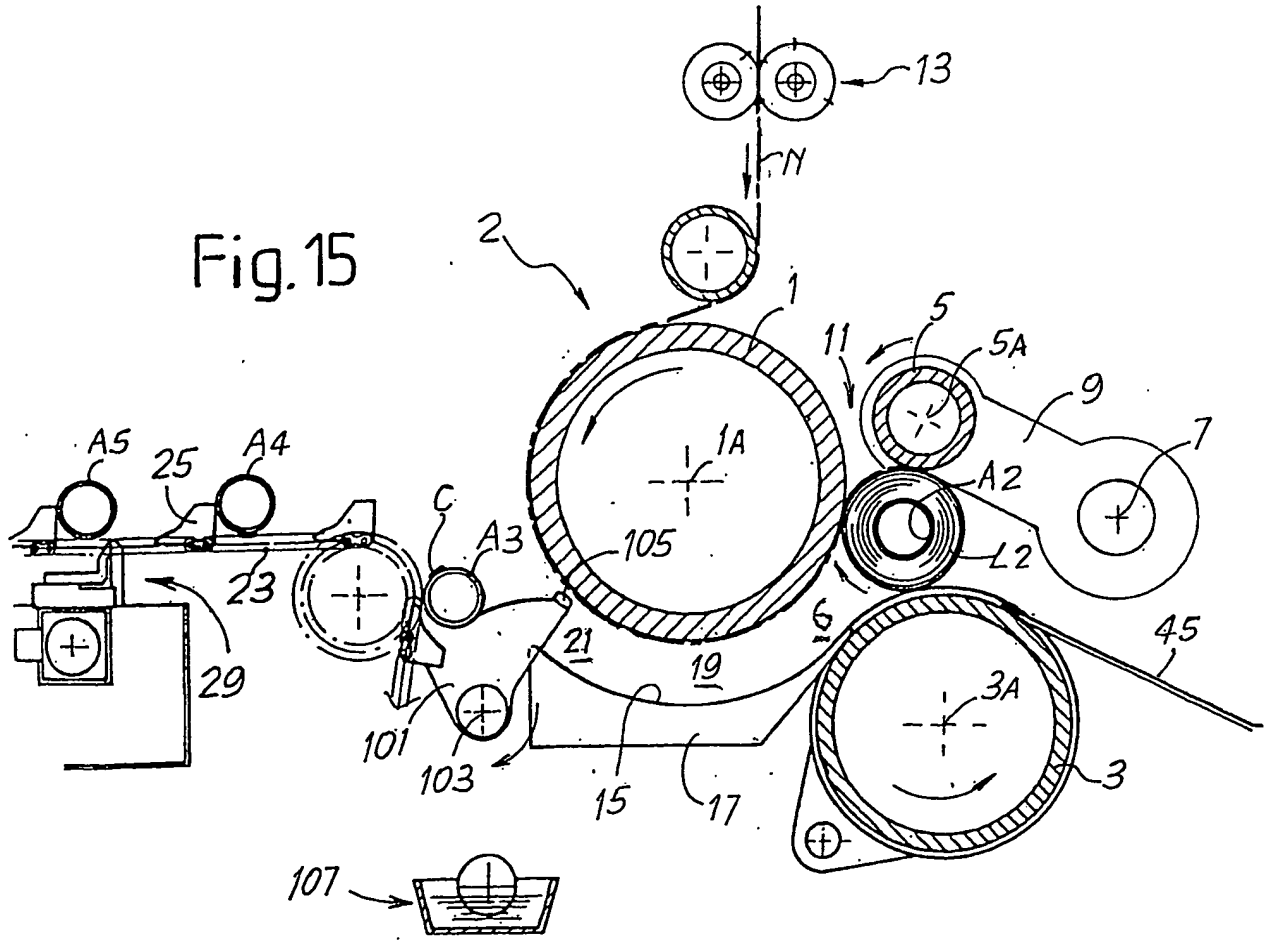
Fig.15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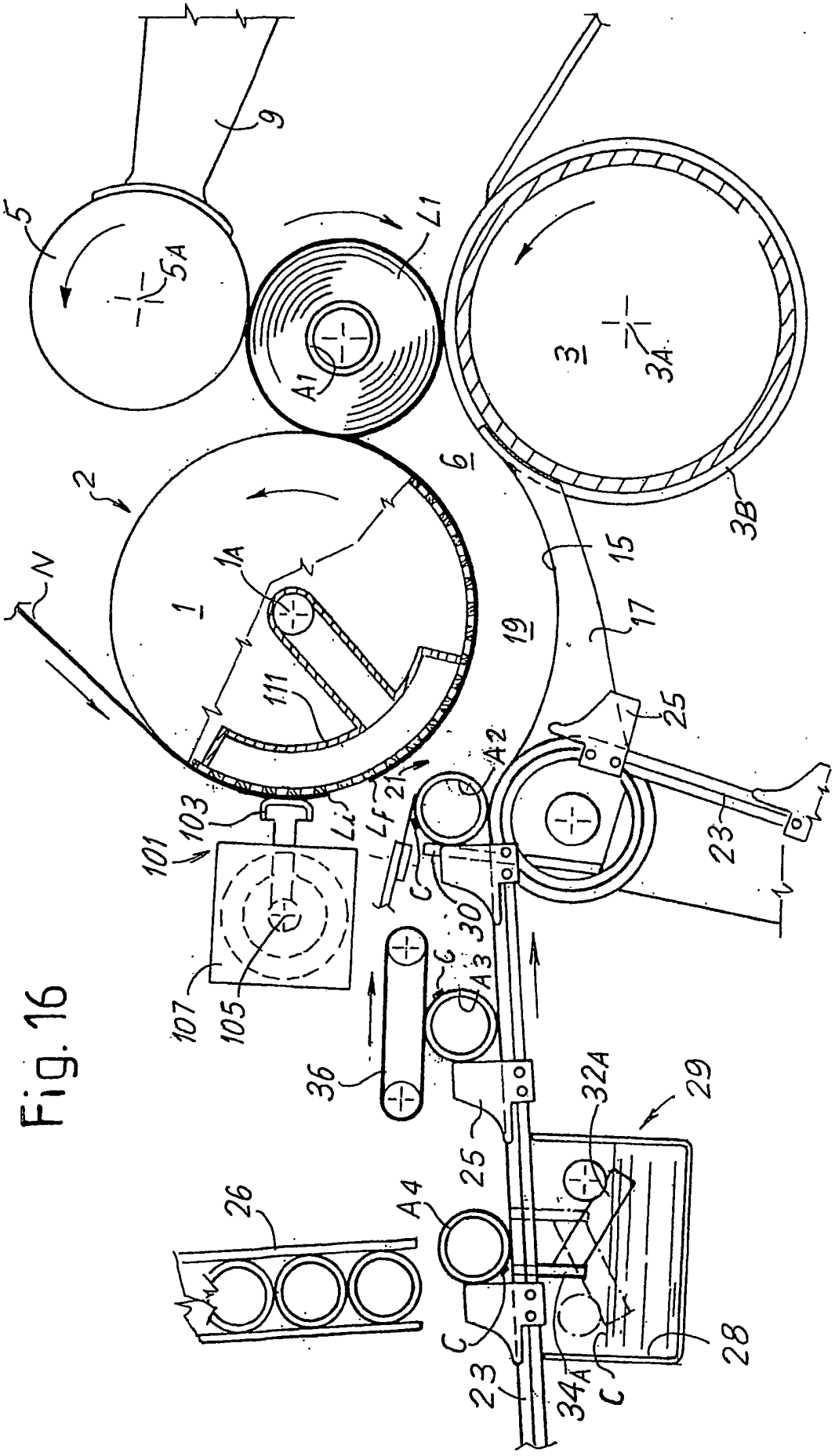
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Fig. 16

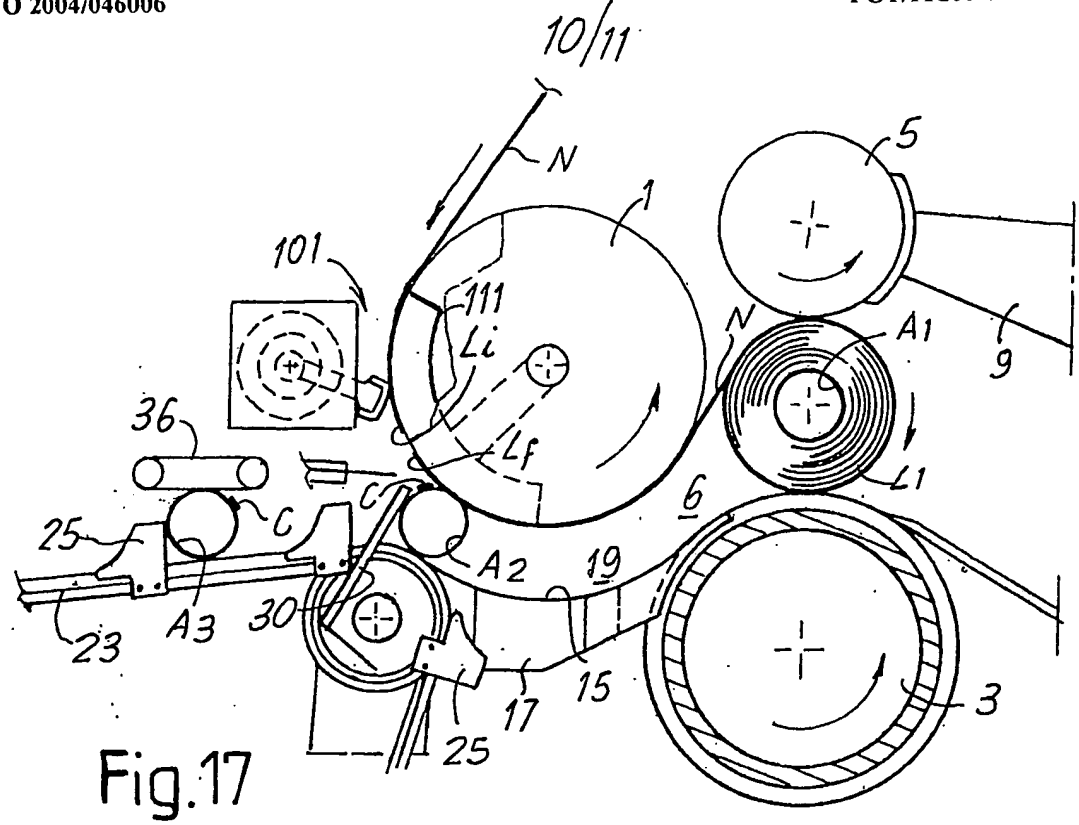
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Fig.17

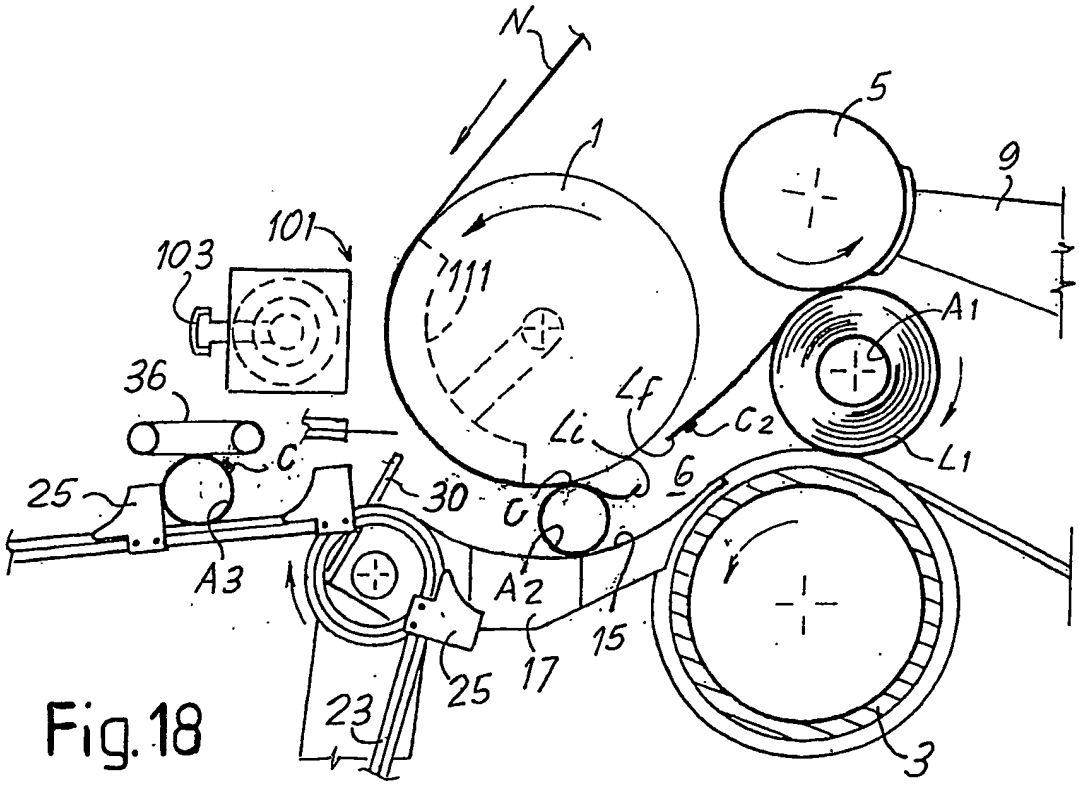
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Fig.18

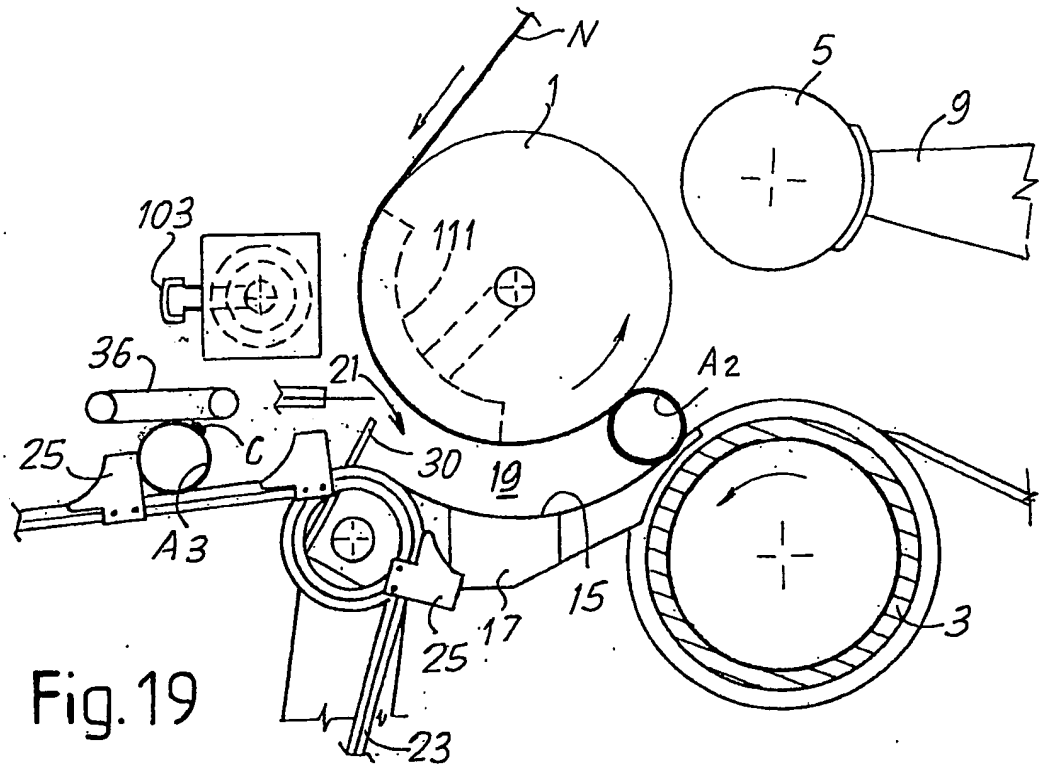
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Fig.19

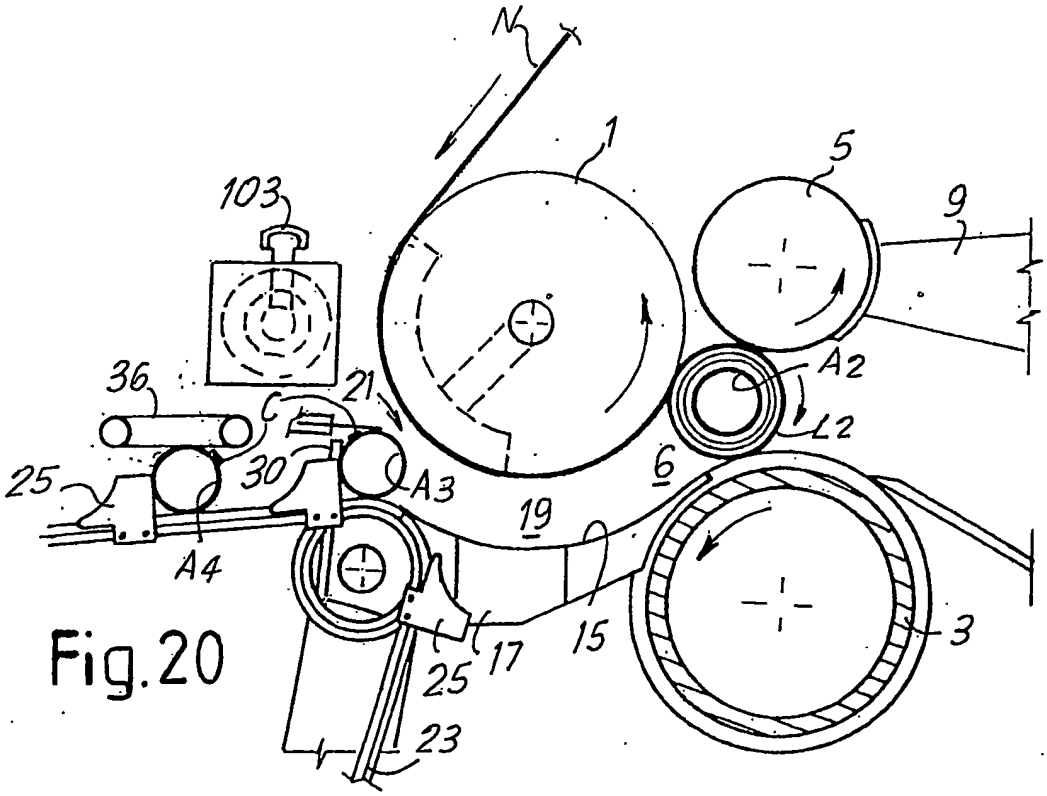
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Fig.20

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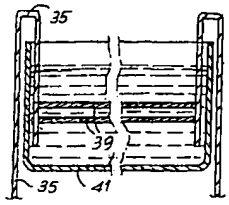
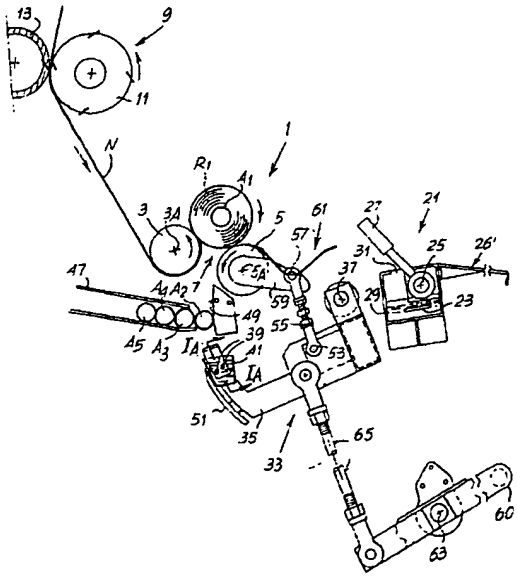
(54) Title: AN IMPROVED REWINDER MACHINE FOR THE PRODUCTION OF ROLLS OF WEB MATERIAL





(57) Abstract: The rewinder machine comprises: a first winding roller (3); a second winding roller (5), defining with said first winding roller (3) a winding cradle; a feeder (33) for sequentially introducing winding cores to said winding cradle; an optional glue applicator (21) for applying glue to said cores. The feeder (33) may include an element (39) for applying glue to the winding cores while they are being fed to said winding cradle. In a special embodiment, the feeder is mechanically linked to a system for unloading the roll from the winding cradle.

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An improved rewinder machine for the production of rolls of web material

Description

Technical Field

This invention relates to a rewinder machine and, more in particular, a so-called peripheral rewinder machine, i.e. one in which the rotary motion of the roll in the formation phase is provided by mobile mechanical members in contact with the external surface of the roll.

More precisely, this invention relates to a rewinder machine of the type including at least two winding rollers which in combination define a winding cradle, optional means of gluing the winding cores or spindles (or other alternative members for initiating the winding around the new winding core) and means of introducing the winding cores into the winding cradle.

The invention also concerns a winding method for the production of rolls of web material wound around winding cores or spindles.

The invention can be implemented both on machines destined for production of rolls where the winding core remains inside, and those for rolls where the winding core is extracted after winding is completed.

State of the art

For the production of rolls of web material, especially rolls of toilet-paper, kitchen towels, and rolls of so-called "tissue" paper in general, starting from large diameter bobbins, machines known as rewinders are used, which wind predetermined lengths of web material around cores made of cardboard or another suitable material. The formed rolls have a diameter equal to that of the finished product and an axial length that is normally greater that that of the rolls destined for sale. These rolls, also known as logs, are subsequently cut orthogonally to their axis to obtain the final product destined for distribution and consumption.

The rewinder machines currently in widest use are of the so-called peripheral type, i.e. in which the roll is formed by keeping it in contact with mobile members, typically two or three rotating rollers. Friction between the winding rollers and the roll being formed keep the latter in rotation around its own axis to wind the desired quantity of web material around the winding core.

An example of this type of rewinder machine is described in US patent 4.327.877. This known rewinder includes three winding rollers, between which the

roll of web material wound around a winding core is formed. The core and the web material are made to pass through a nip defined between a first and a second winding roller. The third winding roller has a mobile axis that permits the diameter of the roll being formed to grow. A feeder member picks up single winding cores and inserts them into the nip between the first and the second winding rollers, towards the winding cradle defined by the three winding rollers. When winding of the roll is completed, it is removed from the winding cradle via a rolling surface that is moved towards the roll, and on which the roll is made to roll down. Blasts of air generate a loop of web material that inserts itself between the new winding core and the lower winding roller, causing the web material to tear and starting the winding of the next roll.

In US patent 4.487.377 a peripheral rewinder machine is described, in which at the end of the winding of each roll the web material is interrupted by the cutting action of a blade located upstream of the insertion nip between the first and the second winding rollers. The winding cores are inserted in the nip between the first and the second winding rollers, towards the winding cradle, via a feeder oscillating around an axis substantially parallel to the axis of rotation of the winding rollers. The cores are fed to the feeder via a chain conveyor that unloads one winding core at a time inside a hopper, from where it is picked up by an oscillating movement of said feeder.

In EP-A-0 524 158 a peripheral rewinder machine is described in which the winding cores are picked up and inserted in the nip between the winding rollers by an oscillating feeder. The web material is torn at the end of winding by a rapid acceleration of the third winding roller in advance of the instant of introduction of the winding core in the nip between the first and the second winding rollers. The breakage of the web material occurs due to the tension on the material itself and its pinching between the main winding roller and the new winding core that is inserted in the winding zone.

In WO-A-94/21545 a peripheral rewinder machine is described that includes a cluster of three winding rollers defining a winding cradle. A rolling surface extends upstream of the winding cradle, which surface defines along with the first winding roller a channel for the insertion of the winding cores. Along this channel, in an intermediate position between the finished roll and the new winding core, a separator member operates, which interrupts the web material at the end of

winding a roll and before starting winding of the next roll.

These rewinder machines run in automatic work cycles at high speed and have complex mechanisms, synchronized with each other, to carry out the interruption of the web material, the discharge of the finished roll and the insertion of the winding core. Systems for applying glue to start winding around a new winding core are also provided. They are therefore very complex and expensive and require large investments, in addition to careful setting up.

In WO-A-97/32804 a peripheral rewinder machine with a special structure is described, having the object of reducing the machine's dimensions and allowing it to be transported, practically without disassembly, inside a single container. This rewinder machine is destined, in particular, to meet the requirements of emerging markets, where it is not possible to make large investments for the purchase of a complex and cumbersome production line. Nevertheless, it continues to be excessively sophisticated and therefore expensive for certain markets, where the consumption of tissue paper, toilet paper and similar products is still limited and insufficient to justify large investments in production plant.

Objects and summary of the invention

In accordance with a first aspect, the object of this invention is to provide a rewinder machine, and in particular, a so-called peripheral rewinder machine, that has even lower costs, small dimensions and extreme constructional simplicity combined with high reliability. In particular, the object of the invention is to provide a machine in which there is limited use of both electronic components and of motors that require reciprocal phasing.

The object of the invention is also to provide a rewinder machine that, thanks to its simplicity, has low maintenance costs and reduces the need for interventions by specialized personnel.

The object of the invention is also to provide a new production method for rolls of web material wound around winding cores.

In accordance with a first aspect, these and further objects and advantages, which will be clear to those skilled in the art from reading the text that follows, are essentially achieved with a rewinder machine comprising, in combination: a first winding roller; a second winding roller, defining with said first winding roller a winding cradle; a feeder for sequentially introducing winding cores towards said winding cradle; and a gluer for applying glue to said cores. Characteristically, in

accordance with the invention, the feeder includes at least one element for applying glue to the winding cores during their introduction into the winding cradle. In this way, the machine becomes substantially simplified, because with a single mechanical member, which can also be manually operated, it is possible to perform the picking up and introduction of the individual winding cores into the machine and apply glue to them, necessary for initiating the winding of the web material around the cores themselves.

In accordance with a possible and advantageous embodiment of the invention, the feeder has at least one elongated member that is immersed in a container of glue arranged below the pick up zone for the winding cores. The elongated member, for example a wire or a cable, becomes covered in glue when it is immersed in the container and will consequently transfer at least part of the glue by contact to each core that is sequentially picked by said feeder and inserted towards the winding cradle. The feeder can have, in accordance with a possible variant of embodiment, two wires or other equivalent elongated members, roughly parallel with each other, for applying two stripes of glue on each winding core. This enables a more stable and reliable anchorage to be achieved for the initial free edge of the web material on the respective winding core.

The feeder can also be provided with an insertion movement, such as a translation for example. Nevertheless, in accordance with a preferred embodiment of the invention, the feeder oscillates around an axis substantially parallel to the axis of the winding rollers. In practice, the feeder can include two mobile arms, oscillating for example, connected to each other and to which the ends of the wire(s) or other elongated members that pick up the glue from the container are constrained. The wire(s) are thus held under tension between the two arms of the feeder.

The arms can be arranged laterally on the outside of the glue container, and have the upper ends bent like an inverted U, on which the glue collecting wire(s) are constrained. In this way, the wires can be immersed in the glue held inside the container while keeping the oscillating arms (except for the free end of each arm) outside of the container itself.

In accordance with a perfected embodiment of the invention, an extractor member can be mechanically linked to the feeder, for extracting a completed roll from said winding cradle. This solution is particularly advantageous as it allows the

roll to be extracted from the winding cradle via a single operation of contextually operating the feeder and the extractor member. In practice, the extractor member can be arranged so that it is hinged around the axis of rotation of the second winding roller and, in addition, is connected to the feeder via a pair of tie rods. In this case, the extractor member has a picking surface for the rolls to be unloaded from the winding cradle. This surface is shaped such that it is tangential to the second winding roller when it is moved alongside the winding cradle to extract and unload the finished roll. The pick up surface can be part of a channel or cradle in which the roll is received and then unloaded with an oscillating movement of the channel itself, or can be constituted by a rolling surface, on which the finished roll is made to roll, under the effect of gravity for example.

The feeder – and in consequence the extractor member for the finished roll, when it is constrained to the feeder – can be controlled by an operator, via a pedal control for example. The operator operates the pedal when the desired amount of web material has been wound around the roll being made. Alternatively, with a modest increase in machine complexity, the operation of the feeder and the members connected to it can be achieved via a mechanical control driven by the machine's main motor or by a pneumatic cylinder.

To facilitate insertion of the winding cores through the nip between the first and the second winding rollers towards the winding cradle, it can be advantageously foreseen, in a manner known per se, that the first and the second winding rollers be controlled to assume, during at least part of the winding cycle of each roll, mutually different peripheral speeds to facilitate the introduction of the winding core through said nip. For example, the second winding roller could be temporarily slowed down. This slowing can also be achieved with a manual intervention by the operator. For example, a band brake could be provided that is operated by the same pedal used by the operator to operate the feeder for the new winding core and the extractor member for the finished roll. Alternatively, a device could be provided on the transmission of the drive to the roller that opportunely and temporarily changes the transmission ratio.

A gluing device for closing the free end edge of the roll can be arranged in the zone for unloading the finished roll from the winding cradle. This device can be entirely manually operated, or can be partially mechanized.

In accordance with a different aspect of this invention, a rewinder machine

is provided for the production of rolls of web material wound around winding cores, comprising: a first winding roller; a second winding roller, defining with said first winding roller a winding cradle; a feeder for sequentially introducing winding cores to said winding cradle. Characteristically, in accordance with the invention, an extractor member for extracting a finished roll from said winding cradle is mechanically linked to the feeder.

In accordance with another aspect, the invention also concerns a method for producing rolls of web material wound around winding cores in which: a first roll is completed in a winding cradle; when winding of said first roll is completed, a new winding core is inserted via a feeder to the winding cradle and the first roll is unloaded from the winding cradle, glue being applied to said winding core. Characteristically, in accordance with the invention, the glue is applied on the new winding core via said feeder.

In accordance with another aspect, the invention contemplates a machine with a special and low-cost control system for the introduction of new cores and the unloading of finished rolls. This system can be embodied with or without using glue for starting the winding. In accordance with this aspect, the invention concerns a rewinder machine for the production of rolls of web material wound around winding cores, comprising:

- a first winding roller
- a second winding roller, defining with said first winding roller a winding cradle
- a feeder for sequentially introducing winding cores to said winding cradle;

characterized in that an extractor member for extracting a finished roll from said winding cradle is mechanically linked to said feeder. In this case, application of the glue can be provided and embodied as described above, or using a different system, although the application of glue can also be eliminated and other systems used for anchoring the free end of the web material to the new winding core.

Additional and secondary characteristics can be shared and combined in a variety of ways in machines with this invention's innovative gluing system and/or the mechanical linkage system of the feeder to the unloading device for finished rolls.

Further advantageous characteristics and forms of embodiment of the method and the machine in accordance with the invention are indicated in the enclosed dependent claims.

Brief description of drawings

The invention will be better understood following the description and attached drawings, which show ractical, non-limitative embodiments of the invention. More in detail, these show:

Figure 1 a schematic side view of a machine in accordance with the invention in a first embodiment,

Figure 1A an enlarged detail along IA - IA in Figure 1,

Figures 2 to 6 successive operational phases of the machine in Figure 1, with the same side view,

Figures 7 to 12 successive operational phases of a rewinder machine in accordance with the invention in a modified embodiment,

Figure 13 another embodiment of the machine in accordance with the invention.

Detailed description of the preferred forms of embodiment of the invention

With initial reference to Figures 1 to 6, in this embodiment, the rewinder, generally designated by reference 1, includes a first winding roller 3 and a second winding roller 5, arranged with their axes of rotation 3A and 5A parallel to each other. A nip 7 is defined between the winding rollers 3 and 5, through which the web material to be wound is fed, indicated by N. The web material N is wound, in the condition shown in Figure 1, around a first winding core indicated by A1, the diameter of which is advantageously slightly larger than the minimum size of the nip defined between the two winding rollers 3 and 5, through which the core passes thanks to its capacity of deformation when squeezed.

The rotary movement imparted to the roll being formed, indicated by R1, is provided by the winding rollers 3 and 5. A perforator group, generally designated by reference 9, is situated along the path of the web material and includes a first rotating cylinder 11 equipped with a perforation blade cooperating with a fixed blade carried on a beam 13. The perforator group creates perforation lines on the web material N, which delimit sections or sheets of web material that can be torn off by the end user.

A gluing device, generally designated by reference 21, for applying the glue necessary for closing the free end edge of the roll formed by the rewinder machine is positioned downstream of the pair of winding rollers 3 and 5, i.e. on the opposite side of the zone from where the web material N to be wound arrives. The gluing

device 21 has a mobile distribution element, indicated by 23, turning around an axis 25 parallel to the axis of the winding rollers 3 and 5. Rotation of the element 23 is manually controlled by a lever 27 operated by the operator of the machine. Glue for closing the finished roll is contained in a tank or container 29 that has an upper opening 31, elongated orthogonally to the plane of the figure and with a width such that the finished roll can remain stably resting on the edges of the slit or opening 31. This enables the gluing of the finished roll to be easily carried out, in the manner described in the following. The width of the aperture 31 can also be adjustable, for example, according to the size of the diameter of the rolls to be produced.

To sequentially insert the winding cores into the winding zone defined by the cradle formed by the winding rollers 3 and 5, a feeder is provided, generally designated by reference 33, comprising a pair of oscillating arms 35 hinged around an axis 37 parallel to the axis of the winding rollers 3 and 5. As shown in the enlarged detail in Figure 1A, the upper ends of the oscillating arms 35 are bent in an inverted U shape and two wires or cables 39 (or other elongated members with equivalent functionality, such as rods, bars, or similar) are anchored by their ends to said upper ends, such that they are under tension and oriented in a direction parallel to the axes of the rollers 3 and 5. The two oscillating arms 35 are arranged laterally at the side of a container or tank of glue 41, which contains the glue to be applied to the winding cores on which the rolls of web material are formed. This glue serves to make the initial edge of each roll adhere to the individual cores. In the position illustrated in Figure 1, the oscillating arms 35 are in their lower position, with the free ends immersed in the tank 41, so that the wires 39 are also immersed in the glue contained in the tank.

A channel 47 is formed in the zone between the position assumed by the pair of oscillating arms 35 of the feeder 33 illustrated in Figure 1 and the pair of winding rollers 3 and 5, in which the winding cores destined to be sequentially introduced to the winding cradle are arranged. The channel 47 terminates in a core-picking zone, from where these are individually picked and transferred to the winding rollers 3 and 5. In Figure 1 there are four cores, indicated by A2, A3, A4 and A5, waiting in the channel 47. A fixed section 49 holds back the first core of the queue of waiting cores. The space between the section 49 and the border of the channel 47 is sufficient for the wires 39 carried by the two oscillating arms 35

to pass, but not enough to let the core A2 fall through, which thus remains in the waiting position.

A shaped plate 51 or a series of teeth are integral with the oscillating arms 35 for the purpose, as will be described in the following, of retaining all of the cores in the channel 47 except for the first core of the queue during the introduction movement of the first core on the queue into the nip defined by the winding rollers 3 and 5.

On the oscillating arms 35, respective tie rods 55 are hinged at 53, with their other ends each hinged at 57 on a corresponding support 59 oscillating around the axis 5A of winding roller 5. The pair of supports 59 have an integral cradle or chute 61 formed by a V-shaped section, with two sides that define the support surfaces for the finished roll, which must be unloaded from the winding cradle formed by the rollers 3 and 5.

The oscillating movement of the arms 35 of the feeder 33, and in consequence of the supports 59 constrained by the arms 35 via the tie rods 55, is controlled by an operator using a pedal 60 hinged around an axis 63 and constrained via tie rods 65 to the oscillating arms 35.

The machine described up to here operates as follows. When the roll R1 being made in the cradle between the rollers 3 and 5 reaches the desired size, determined by the operator or, for example, by a counter that detects the length of the wound web material N or the number of perforations performed on the web material by the perforator group 9, the operator uses the pedal 60 to control the raising of the feeder 33. During a first segment of travel of the pedal 60, which moves from the position in Figure 1 to the position in Figure 2, the oscillating arms 35 pick up the core A2 waiting at the outlet of the channel 47 and lift it towards the nip defined by the winding rollers 3 and 5. Contact of the core A2 with the wires 39 covered in glue carried by the oscillating arms 35 causes not just the lifting of the core, but also the application of two lines of glue on its surface. The shaped section 51 that is integrally raised with the arms 35 holds back the other cores A3, A4 and A5 inside the channel 47 while the core A2 is inserted into the nip between the winding rollers 3 and 5. Using a clutch control, or a brake or other known suitable means (optionally controlled by the same pedal 60) a deceleration of the winding roller 5 is also produced. This facilitates insertion of the winding core A2 through the nip 7, when the core itself makes contact with the cylindrical surfaces

of the two winding rollers 3 and 5. This contact occurs by lifting the oscillating arms 35 further upwards with respect to the position shown in Figure 2. This additional oscillating movement is caused by the operator depressing the pedal 60 even more. The additional depression of the pedal 60 follows the insertion of the core inside the nip 7 and causes a further oscillation of the supports 59 hinged around the axis 5A and consequently of the chute 61 that is integral with the supports. The left side (in the figures) of the chute 61 thus inserts itself (see Figure 3) between the winding roller 5 and the finished roll R1. The roll, because of its inertia due to the rotary motion it possesses, jumps inside the chute 61 as shown in Figure 3. In this way, the roll halts and the web material slackens. In the meantime, the winding core A2 that has made contact with the winding rollers 3 and 5 starts to roll forwards through the nip 7 due to the different peripheral speeds of the two rollers. The glue applied by the wires 39 on the cylindrical surface of the winding core A2 causes adhesion of the web material N that has become slack, as described above. Thus, the material enters and remains glued to the core, between the latter and the second winding roller 5. This provokes the tearing of the material along a line of perforation. Alternatively, the tear could be made with a manual operation by the operator. The tear generates a free initial edge of a new roll, which starts to form itself around the second winding core A2, as well as the final edge of the finished roll R1, which will be made to adhere to the roll in the manner described further on.

Once the finished roll R1 is in the chute 61 and the new winding core A2 has been inserted into the nip 7 between the winding rollers 3 and 5, the operator can release the pedal 60, so that the various members assume the positions in Figure 4. The set-up shown in Figure 4 corresponds to that of Figure 1, except for the fact that the new roll being formed in the winding cradle 3 and 5 (indicated by R2) is in its initial winding phase and therefore has a smaller diameter, while previously wound roll R1 is still in the chute 61. From here, the operator manually picks the roll and, after having unrolled and positioned the end edge as shown in Figure 5, rests it on the opening 31 of the container 29, which contains the glue provided for closing the free edge of the finished roll. As previously mentioned, the transversal size of the opening 31 is such that the roll resting on it is in stable equilibrium. The operator operates the lever 27 to bring the mobile element 23 into contact with the surface of the finished roll R1, in an angular position on which the

previously unrolled free end edge Lf will again be laid. At this point, closure of the roll is performed by making the roll R1 roll on the surface 26 that is downstream of the opening 31 of the container 29.

Figures 7 and 12 show a modified form of embodiment of the invention, in various successive moments during the winding cycle. Parts that are the same or correspond to those in the previous example of embodiment are indicated by the same reference numerals.

Essentially, the embodiment in Figures 7 to 12 differs from the previous one in the greater automation of the machine. The feeder 33 is no longer controlled by a pedal. Rather, in this case, the tie rods 65 each constitute the connecting rod of a crank and con-rod system 65 and 46. The crank 46 turns around an axis 63. The rotation is controlled by a suitable transmission that can possibly take its drive directly from the main motor, or from an independent actuator, which could be an electric motor or even just a hydraulic or pneumatic plunger-cylinder actuator.

In this embodiment, the chute 61 is substituted by a surface 62 shaped – similarly to the left side of the chute 61 in the figures - for inserting itself between the winding cylinder 5 and the finished roll R1. The surface 62 is still integral with a pair of supports 59 hinged and oscillating around the axis 5A of rotation of the winding roller 5, and connected to the oscillating arms 35 of the feeder 33 via tie rods 55. The tie rods 65 thus, in addition to the oscillation of the arms 35, also provoke the oscillation of the supports 59 and the surface 62 that serves for extracting the finished roll from the winding cradle and to unload it onto a slide 64. The operator can pick up the roll from the latter for gluing it, for example, by using a gluing device similar to device 21 and not illustrated. The finished roll could also roll directly onto the gluer, by eliminating the abutment illustrated in the figures at end of the slide 64.

Additional differences with respect to the previous embodiment is the presence on the machine in Figures 7 to 12 of a third winding roller 8 carried by a pair of oscillating arms 10 hinged around an oscillation axis 12. The oscillating movement of the arms 10 allows the roller 8 to gradually raise to follow the growing diameter of the roll being formed. The roller 8 can be motorized, using the same motorization that drives the rotation of the winding rollers 3 and 5, or it can be an idle roller. In addition, a cylinder 14, also motorized or idle, with a fixed axis, is positioned next to the third winding roller 8. The position of the cylinder 14 is

adjustable so that it can be set at a distance from the position taken by the surface 62 during the unloading of the finished roll, such that the latter makes simultaneous contact with the surface 62 and the cylinder 14.

In the example described herein, contrary to that illustrated in the previous example, the oscillating arms 35 carry a single wire 39, although the possibility of using two or more wires is not excluded.

Operation of the machine in this configuration is clearly illustrated in the series of Figures 7 to 12. Rotation of the crank 46 provokes the following operations, in the illustrated sequence. The oscillating arms 35 are raised and they pick up the first core A2 on the waiting queue in the channel 47, taking it to the nip 7 defined between the winding rollers 3 and 5. In this phase, a line of glue is applied to the core by the wire stretched between the two oscillating arms 35 of the feeder. The rising movement of the arms 35 provokes an anticlockwise oscillation of the supports 59 and thus the introduction of the surface 62 between the finished roll R1 and the winding roller 5. The surface 62 with the supports 59 therefore constitutes an extractor member for the finished roll, a member that in the previous example of embodiment was constituted by the supports 59 and the chute 61.

Continuing the rotation of the crank 46 completes the introduction of the core A2 into contact with the winding rollers 3 and 5 in the nip 7, which the core passes through thanks to the peripheral speed differential between the two rollers. The difference in peripheral speed is achieved, for example, with a temporary deceleration of the winding roller 5. The web material N is torn (Figure 9) as described in the previous example, while the finished roll R1, entering into contact with the surface 62 (which is substantially motionless in this phase) moves away from the winding cradle, losing contact with the winding rollers 3 and 5. In the passage from the position in Figure 9 to the position in Figure 10, the crank 46 continues to turn, making the oscillating arms 35 of the feeder 33 drop down again and also making the surface 62 drop. The finished roll has passed beneath the cylinder 14 and now rolls on the slide 64 towards a lower abutment provided at the end of the slide.

The roller 14 serves to slow the movement of the roll in the unloading phase, in this way causing the web material to become slack so that it can wedge between the new core and the second winding roller, for carrying out the tear.

In Figures 11 and 12 it can be observed how the oscillating arms 35, and also the surface 62, are kept still, while the finished roll R1 stops at the end of the slide 64 and a new roll R2 is formed around the new winding core A2 in the cradle defined by the winding rollers 3, 5 and 8.

Figure 12 also shows a band brake, omitted in the previous figures for the sake of clarity of the drawings, which serves to provoke the temporary slowing of the winding roller 5. The band brake includes a band 101, a first end of which is anchored at 103 to an elastic system 105 fixed to the structure (non illustrated) of the machine. The opposite end of the band 101 is fixed at 107 to the crank 46. In this way, the rotation of the crank 46 automatically provokes the tensioning of the band 101 and thus the braking of the winding roller 5 in the phase where the slowing of the roller is required, i.e. in the phase illustrated in Figures 8 and 9. In this way, the insertion of the winding core, the unloading of the roll and the slowing of the winding roller 5 is achieved with a single control.

The winding core can remain inside the roll produced by the described machine. Alternatively, and in a known manner, the winding core can be fashioned to permit its extraction from the finished roll. For example, it could be made of plastic to facilitate slipping out and optionally have abutments at one or both ends for performing extraction via a mechanical extractor. The cores extracted from the finished rolls can be manually recycled by the operator.

Figure 13 illustrates a modified embodiment of the invention. Alike numbers indicate the same or equivalent parts to those of the previous examples of embodiment. With respect to the embodiment in Figures 7 to 12, the machine in Figure 13 differs first of all for the absence of a gluing system for the winding cores A. These are picked up via a feeder 33 from a channel 47 and are directly inserted through the nip 7 between the winding rollers 3 and 5. The start of winding is achieved by blasts of air emitted by nozzles 4A and 4B, opportunely oriented with respect to the path of the web material N and that of the winding core A, so as to start winding the first turn of material around the core. Initial winding systems of this type are known from the state of the art and do not require detailed description. As can be seen in the drawing, the nozzles are arranged in two positions, above and below the nip between the rollers 3 and 5, in two rows substantially parallel to the axes of rotation of the rollers.

In addition, in the example in Figure 13 there is no con-rod and crank

system 46 and 65, which is substituted by a pedal 60 similar to that of the embodiment in Figures 1 to 6.

In the absence of a glue distributor, the feeder 33 will have a different shape with respect to the previous configuration, as it no longer needs to perform the glue distribution function. It will therefore have a simple profile for the insertion of cores into the winding cradle, or will be equipped (as in the illustrated example) with a double series of staggered wheels defining a cradle for receiving the new core to be introduced into the winding zone. In certain cases, just a single series of support rollers or wheels for the winding core could be provided.

Secondly, to also permit the utilization of winding cores A that are not compressible or deformable, or only deformable with difficulty, in the example shown in Figure 13 the winding roller 5 has a covering 5B made with a pliable material, such as rubber or similar, of adequate softness. In this way, when the feeder 33 inserts a new core A in the nip 7, the difference between the diameter of the core A and the size of the nip can be compensated by compression of the covering 5B of the winding roller, instead of squeezing the core. This solution, which can also be adopted in one or the other of the two machines illustrated in the previous figures, also permits metal winding cores to be used, in aluminium for example, which do not compress sufficiently for passing through the nip 7. In particular, cores of this type can be used when the winding cycle contemplates the subsequent extraction of the winding core and its recycling. A recyclable core can be used on a winding system without glue, as in the case of Figure 13, or using glue, a watery glue for example, which can easily be removed from the core or even not leave any residues on the winding core once this has been extracted from the finished roll.

The third aspect that differentiates the machine in Figure 13 with respect to the machine in Figure 7 consists in the fact that the same pedal 60, with which the raising of the feeder 33 and the oscillation of the surface 62 is controlled, serves to control the mobile glue distribution element 23 for closure of the end edge of the roll R. For this purpose, in addition to the tie rod 65, a second tie rod 66 is hinged on the pedal 60, the opposite end of said second tie rod being linked to a lever 68 integral with the element 23 and oscillating around the axis 25. As can be observed from comparing Figures 7 and 13, the rotation around the axis 25 occurs in the opposite direction in the two cases: in Figure 7, the mobile element 23

covers itself in glue by immersing itself in the tank 29 with an anticlockwise rotation and inserts itself into the slot or upper opening 31 via a clockwise oscillating movement. In Figure 13, when the pedal is raised, the element 23 is in the position of maximum oscillation in the anticlockwise direction and is positioned in the slot. To immerse it in the glue contained in the tank 29 it is necessary to press the pedal 60 to provoke a clockwise rotation of the element 23 and thus its immersion.

With this arrangement, when a finished roll R must be unloaded and glued, the operator presses the pedal 60 and provokes the expulsion of the roll and the immersion of the element 23 in the glue. Releasing the pedal, the element 23 positions itself at the correct point for gluing and the operator can proceed with carrying out the gluing operation.

In the configuration shown in Figure 13, when the pedal 60 is pressed, the roll is unloaded down the slide 26' to a position from where it is taken by the operator, without receiving glue, because the pedal 60 is pressed and the distributor is therefore down. Along the slide 26' markings S1 and S2 of a scale are provided, that permits the operator to position the roll with the unglued free edge on the marker point and make it roll upwards along the slide 26' until it reaches the contact position defined by the upper end wall of the tank 29, where the glue distribution slot 31 is located. The markings S1 and S2 correspond to various roll diameters and are set so that when a roll is rolled upwards from a marker with the same corresponding diameter, the amount of web material that is unwound corresponds exactly to that required for applying the glue in the correct position on the cylindrical surface of the roll that – being made to roll by the operator – reaches the gluing position.

The possibility of also using a dual tie rod in a similar configuration to that of Figures 7 to 12 is not excluded, with a motorized shaft controlling the movement of the tie rod operating the feeder and the tie rod operating the roll gluer.

The various new characteristics described with reference to the various examples of embodiment can be combined with each other in various ways. Any combination or sub-combination of characteristics that is new and inventive constitutes the specific subject of this invention.

In particular, according to a further aspect, the subject of the present invention is a continuous surface rewinder machine for the production of rolls of web material wound around winding cores. By continuous surface rewinder

machine a rewinder is understood, where the rolls are formed by keeping them into rotation through contact with peripherally arranged winding rollers, and wherein the web material to be wound is fed continuously, without interruption between completion of one roll and starting the winding of the subsequent roll. According to this aspect of the invention, the rewinder machine comprises only two winding rollers forming a winding cradle, on which rolls of web material are sequentially formed. Conversely usually known continuous surface rewinders are provided with a cluster of three rollers forming a winding cradle, one of said roller at least being movable to allow roll diameter increase.

According to this further aspect, the invention also relates to a method for subsequently forming rolls of web material wound around winding cores, including the steps of:

- providing a first winding roller and a second winding roller forming a winding cradle;
- continuously feeding said web material to said winding cradle to form a roll in said cradle, said roll being formed by contacting it with only said two winding rollers;
- upon completion of said roll, discharging said roll from said cradle, inserting a new core in said cradle and severing said web material, without interrupting feeding of said web material.

It is understood that the drawings only illustrate practical forms of embodiment of the invention, which can vary in form and arrangement without leaving the scope of the concept at the base of the invention. The only purpose of the presence of any reference numerals in the attached claims is that of facilitating the reading of the claims in relation to the foregoing description and the enclosed drawings, and does not limit the scope of protection in any way.

Claims

1. A rewinder machine for the production of rolls of web material (N) wound around winding cores (A1-A4), comprising:

- a first winding roller (3),
- a second winding roller (5), defining with said first winding roller (3) a winding cradle,
- a feeder (33) for sequentially introducing winding cores to said winding cradle,
- a gluer (21) for applying glue on said cores,

characterized in that said feeder (33) includes at least one element (39) for applying said glue to the winding cores during their introduction to said winding cradle.

2. A rewinder machine according to claim 1, characterized in that said element for applying glue to the cores includes at least one elongated member (39) that is immersed in a container (41) of glue arranged beneath a zone for picking up the winding cores, said elongated member covering itself in glue in said container and transferring said glue by contact to each core sequentially picked by said feeder.

3. A rewinder machine according to claim 2, characterized in that said feeder has two elongated members (39).

4. A rewinder machine according to claims 2 or 3, characterized in that said feeder includes two mobile arms (35) between which said at least one elongated member is supported.

5. A rewinder machine according to one or more of the previous claims, characterized in that said feeder (33) oscillates around an axis (37) substantially parallel to the axis of the winding rollers.

6. A rewinder machine according to one or more of claims 2 to 4, characterized in that said elongated member is composed of a wire or a cable stretched between the two mobile arms.

7. A rewinder machine according to one or more of the previous claims, characterized in that an extractor member (53-62), for extracting a roll (R1) formed in said winding cradle, is mechanically linked to said feeder (33).

8. A rewinder machine according to claim 7, characterized in that said extractor member (53-62) oscillates around an axis parallel to the axis of at least

one of said winding rollers.

9. A rewinder machine according to claim 8, characterized in that said extractor member is constrained around the axis of rotation (5A) of said second winding roller (5).

10. A rewinder machine according to claims 7 or 8 or 9, characterized in that said extractor member has a pick up surface (61 and 62) for rolls (R) to be unloaded from said winding cradle.

11. A rewinder machine according to claim 10, characterized in that said extractor member includes a pair of oscillating arms (59) articulated around the axis of rotation (5A) of the second winding roller (5), to which said pick up surface is rigidly constrained, and that said oscillating arms (59) are linked to said feeder (33) via tie rods (55) hinged to said arms and to said feeder.

12. A rewinder machine according to claims 10 or 11, characterized in that said pick up surface forms a picking chute (61) for said rolls.

13. A rewinder machine according to claims 10 or 11, characterized in that said pick up surface forms a rolling surface (62) for said rolls.

14. A rewinder machine according to one or more of claims 10 to 13, characterized in that said pick up surface (62) is shaped to insert itself between the roll and the second winding rollers, being substantially tangential to said second winding roller.

15. A rewinder machine according to one or more of the previous claims, characterized in that said feeder (33) is manually controlled.

16. A rewinder machine according to one or more of the previous claims, characterized in that said feeder is controlled by a main motor that also controls the rotation of said first and of said second winding rollers.

17. A rewinder machine according to one or more of claims 1 a 15, characterized in that said feeder is controlled by an independent actuator.

18. A rewinder machine according to one or more of the previous claims, characterized in that it includes a perforator (9) for perforating the web material along transversal perforation lines, and that said perforator is controlled by the same motor that controls said first and said second winding rollers.

19. A rewinder machine according to one or more of the previous claims, characterized in that said first and said second winding rollers are controlled to assume, during at least part of the winding cycle of a roll, mutually different

peripheral speeds to facilitate introduction of the winding core through the nip defined between said first and said second winding rollers.

20. A rewinder machine according to claim 19, characterized in that the change in peripheral speed of said first and second winding roller with respect to each other is manually controlled.

21. A rewinder machine according to claims 19 or 20, characterized in that it includes a brake (101-107) for braking the second winding roller (5), temporarily changing the peripheral speed of the second winding roller with respect to the peripheral speed of the first winding roller.

22. A rewinder machine according to claim 21, characterized in that said brake is manually operated via a control that also operates said feeder.

23. A rewinder machine according to one or more of the previous claims, characterized in that it includes a feed channel (47) for the winding cores, said feeder (33) being equipped with a retaining surface (51) that holds the cores in said feed channel.

24. A rewinder machine according to one or more of the previous claims, characterized in that it includes a third winding roller (8) with a moveable axis.

25. A rewinder machine according to one or more of the previous claims, characterized in that a gluing device (21) is arranged downstream of said first and second winding rollers for gluing the free end edge of the roll.

26. A rewinder machine according to claim 25, characterized in that said gluer is manually controlled.

27. A rewinder machine according to claims 25 or 26, characterized in that said gluing device has a support surface for the roll to be glued, with an opening (31) defining a position of equilibrium for said roll, and with a mobile element (23) for distributing the glue arranged beneath said opening.

28. A rewinder machine according to claim 27, characterized in that said mobile glue distribution element is operated by a manual control (27).

29. A machine according to one or more of claims 25 to 29, characterized in that it includes a pair of tie rods (65 and 66), controlled by the same drive shaft (63) used for controlling the movement of the feeder and the movement of said gluing device (21).

30. A machine according to claim 29, characterized in that said two tie rods are controlled by a pedal (60).

31. A machine according to one or more of the previous claims, characterized in that one of said winding rollers has a pliable cylindrical surface (5B).

32. A rewinder machine for the production of rolls of web material (N) wound around winding cores (A1-A5), comprising:

- a first winding roller (3),
- a second winding roller (5), defining with said first winding roller (3) a winding cradle,
- a feeder (33) for sequentially introducing winding cores to said winding cradle,

characterized in that an extractor member (53-62), for extracting a roll formed in said winding cradle, is mechanically linked to said feeder (33).

33. A rewinder machine according to claim 32, characterized in that said extractor member oscillates around an axis parallel to the axis of at least one of said winding rollers.

34. A rewinder machine according to claim 33, characterized in that said extractor member is constrained around the axis of rotation (5A) of said second winding roller (5).

35. A rewinder machine according to claims 32 or 33 or 34, characterized in that said extractor member has a pick up surface (61 and 62) for rolls (R) to be unloaded from said winding cradle.

36. A rewinder machine according to claim 35, characterized in that said extractor member (53-62) includes a pair of oscillating arms (59) articulated around the axis of rotation (5A) of the second winding roller (5), to which said pick up surface is rigidly connected, and that said oscillating arms (59) are linked to said feeder (33) via tie rods (55) hinged to said arms and to said feeder.

37. A rewinder machine according to claims 35 or 36, characterized in that said pick up surface (61) forms a picking cradle for said rolls.

38. A rewinder machine according to claims 35 or 36, characterized in that said pick up surface (62) forms a rolling surface for said rolls.

39. A rewinder machine according to one or more of claims 35 to 38, characterized in that said pick up surface (62) is shaped to insert itself between the roll and the second winding roller, being substantially tangential to said second winding roller.

40. A machine according to one or more of claims 32 to 39, characterized in that one of said winding rollers has a pliable cylindrical surface (5B).

41. A machine according to one or more of claims 32 to 40, characterized by a pair of tie rods (65, 66), controlled by a common drive shaft (63) used for controlling the movement of the feeder and the movement of said gluing device (21).

42. A machine according to claim 41, characterized in that said two tie rods are controlled by a pedal (60).

43. A method for producing rolls of web material wound around winding cores: in which

- a first roll (R1) is completed in a winding cradle,
- upon termination of winding said first roll, a new winding core (A2) is inserted via a feeder (33) to said winding cradle and the first roll is unloaded from the winding cradle, with glue being applied to said new winding core,

characterized in that said glue is applied on said new winding core via said feeder (33).

44. A method according to claim 43, characterized in that said feeder is immersed at least partially in a container of glue and lifted from it to pick the new winding core, said feeder pushing said winding core into a nip defined between a first and a second winding roller.

45. A method according to claims 43 or 44, characterized by extracting the winding core from the finished roll and recycling it for a subsequent winding cycle.

46. A method for producing rolls of web material wound around the winding cores: in which

- a first roll (R1) is completed in a winding cradle,
- upon termination of winding said first roll, a new winding core (A2) is inserted via a feeder (33) to said winding cradle and the first roll is unloaded from the winding cradle via an extractor member (51-61),

characterized by controlling said feeder and said extractor member via a common member.

47. A rewinder machine for the production of rolls of web material (N) wound around winding cores (A1-A5), comprising: a first winding roller (3); a

second winding roller (5), defining with said first winding roller (3) a winding cradle; a feeder (33) for sequentially introducing winding cores to said winding cradle; a gluer (21) for gluing the free end edge of the rolls made by said machine, characterized in that a common actuator member (60) controls the movement of said feeder and of said gluer (21).

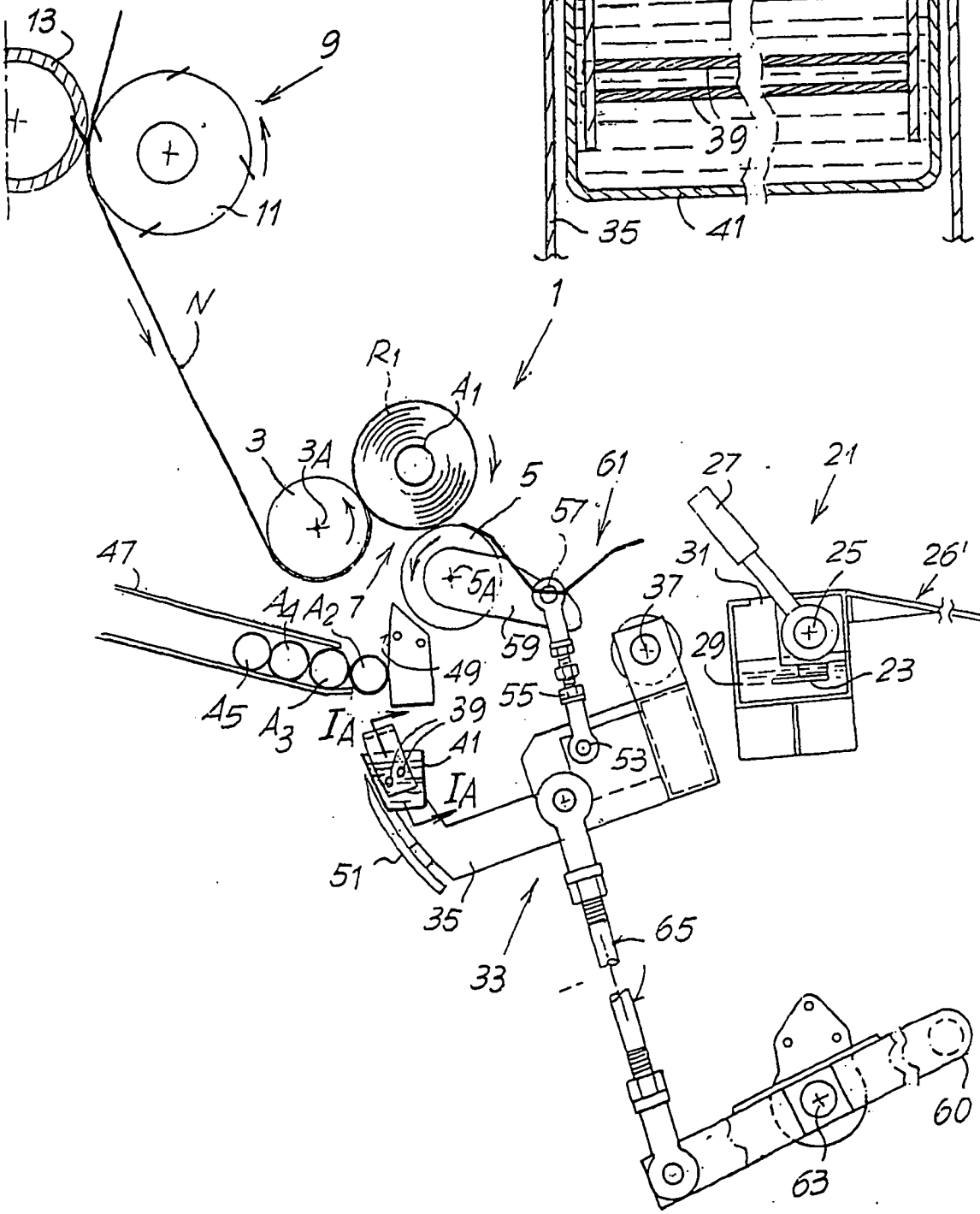
48. A rewinding machine for the production of rolls of web material (N) wound around winding cores (A1-A5), comprising only two winding rollers (3, 5) forming a winding cradle, on which rolls of web material are sequentially formed, wherein said web material is fed continuously to said cradle, said winding rollers being kept into rotation during discharge of a completed roll and insertion of a new winding core.

49. A rewinding machine according to claim 48, wherein said cores and said web material are fed through a nip (7) formed between said two winding rollers (3, 5).

50. A method for subsequently forming rolls of web material wound around winding cores, including the steps of:

- providing a first winding roller and a second winding roller forming a winding cradle;
- continuously feeding said web material to said winding cradle to form a roll in said cradle, said roll being formed by contacting it with only said two winding rollers;
- upon completion of said roll, discharging said roll from said cradle, inserting a new core in said cradle and severing said web material, without interrupting feeding of said web material.

Fig.1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R1
A1
3
3A
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57
27
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A4
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Fig.1A

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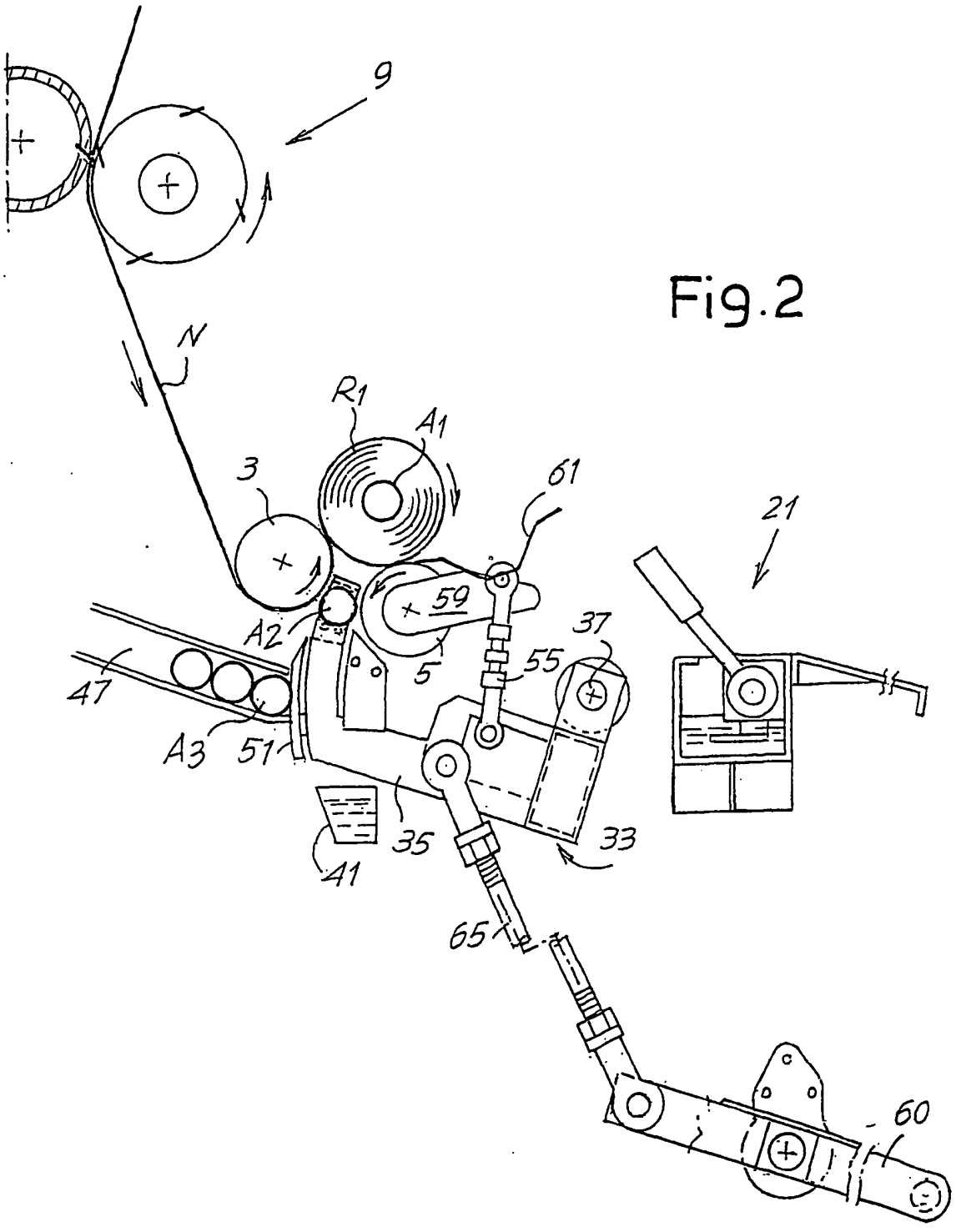

Fig.2

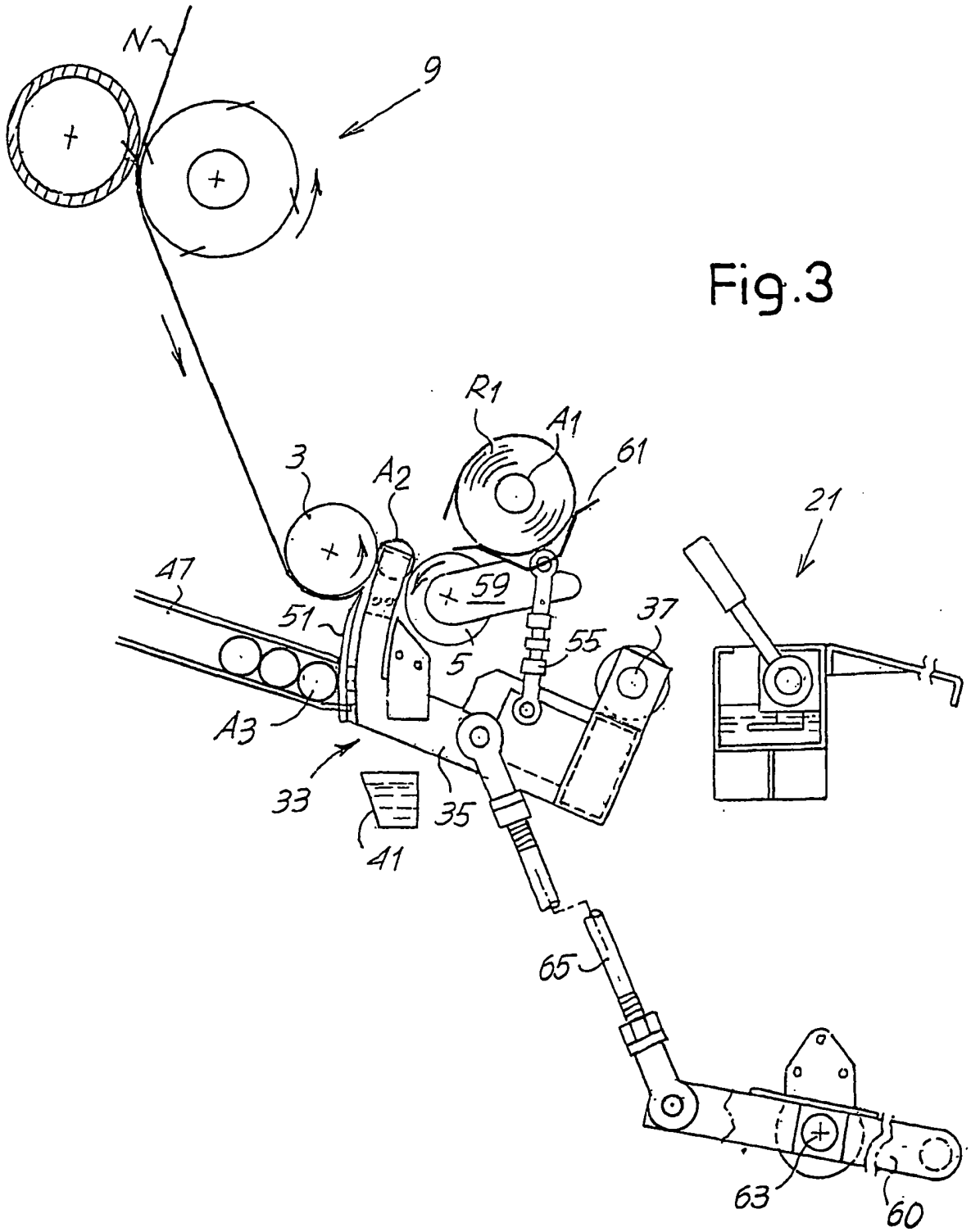

Fig.3

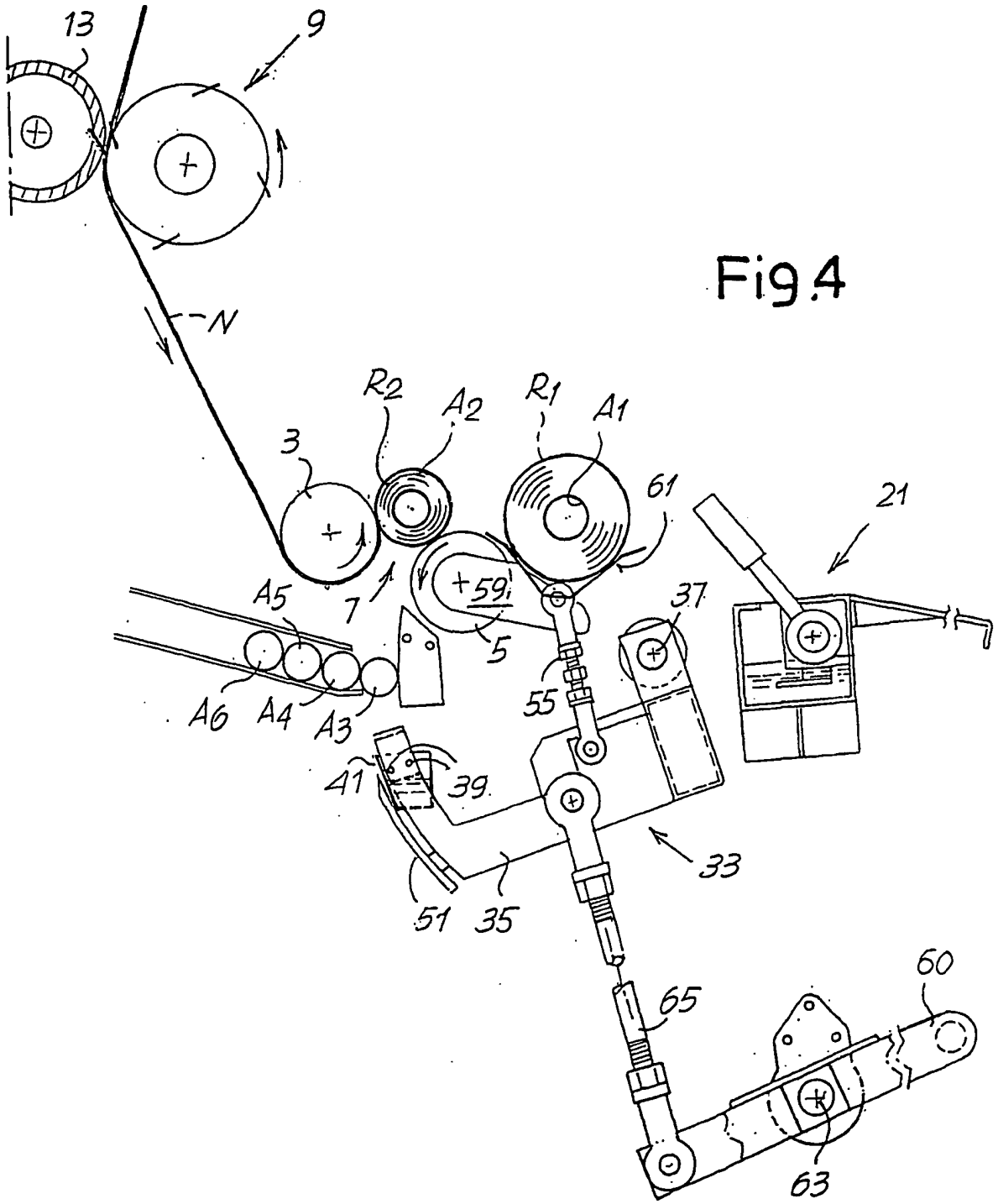

Fig.4

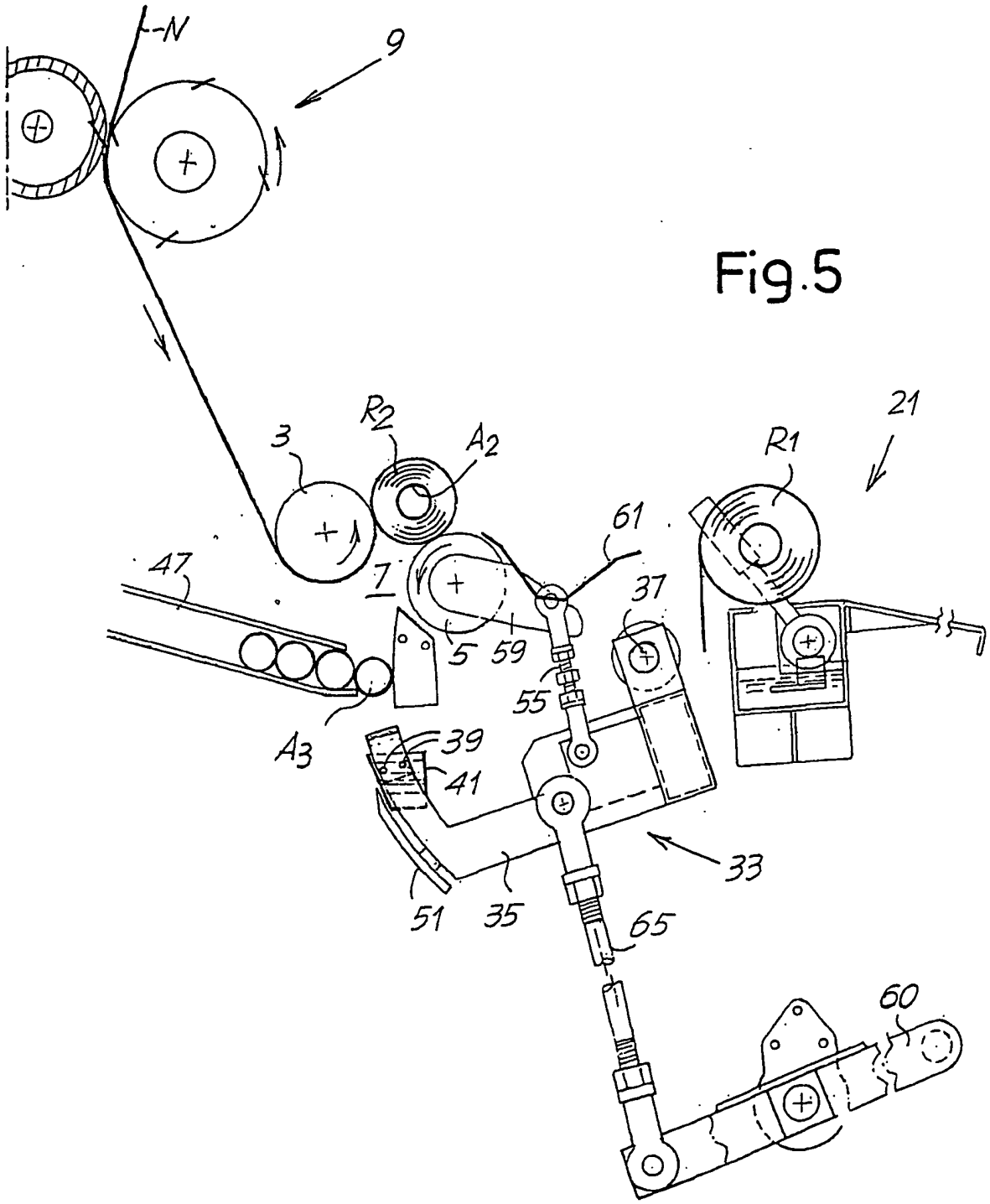

Fig.5

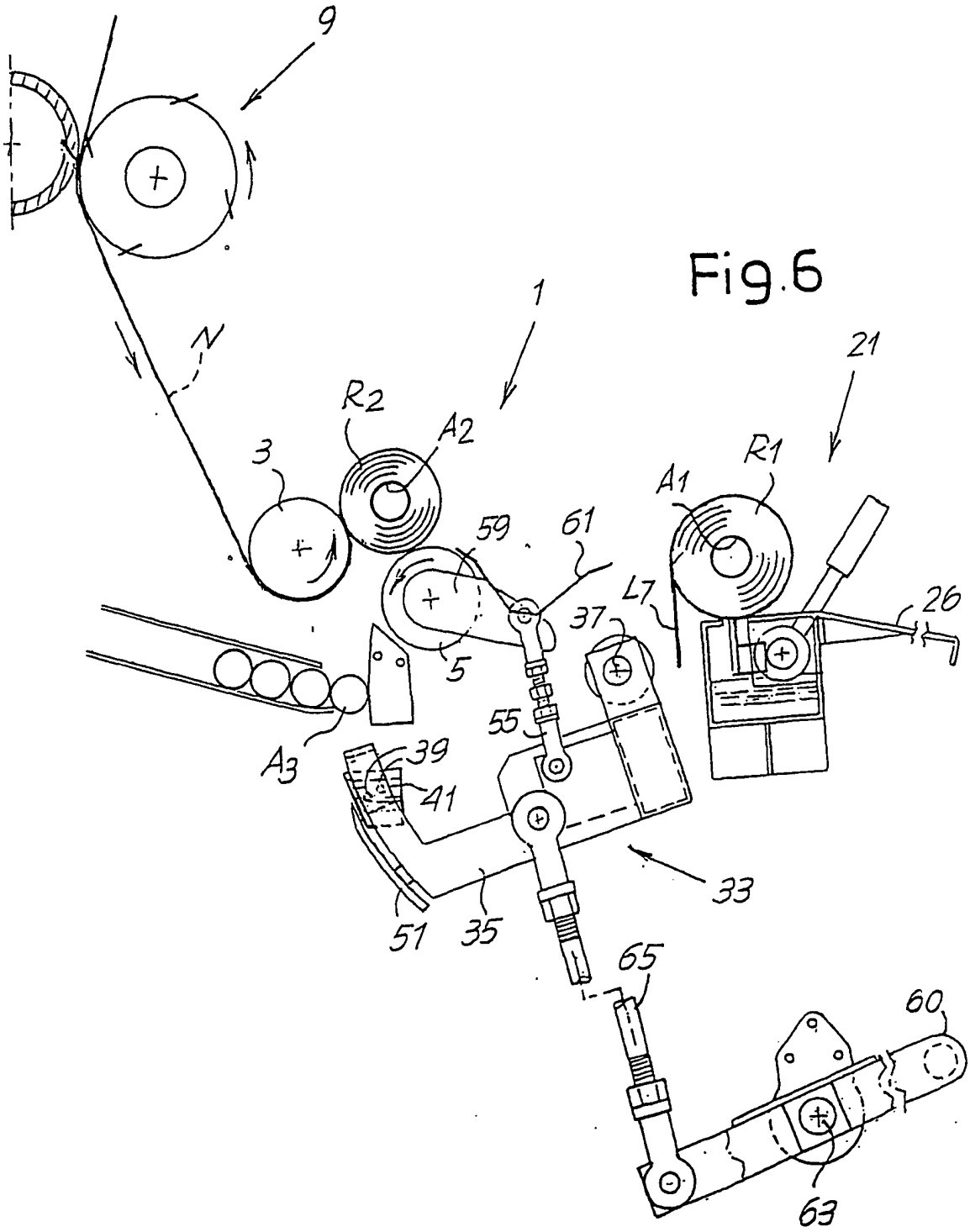

Fig.6

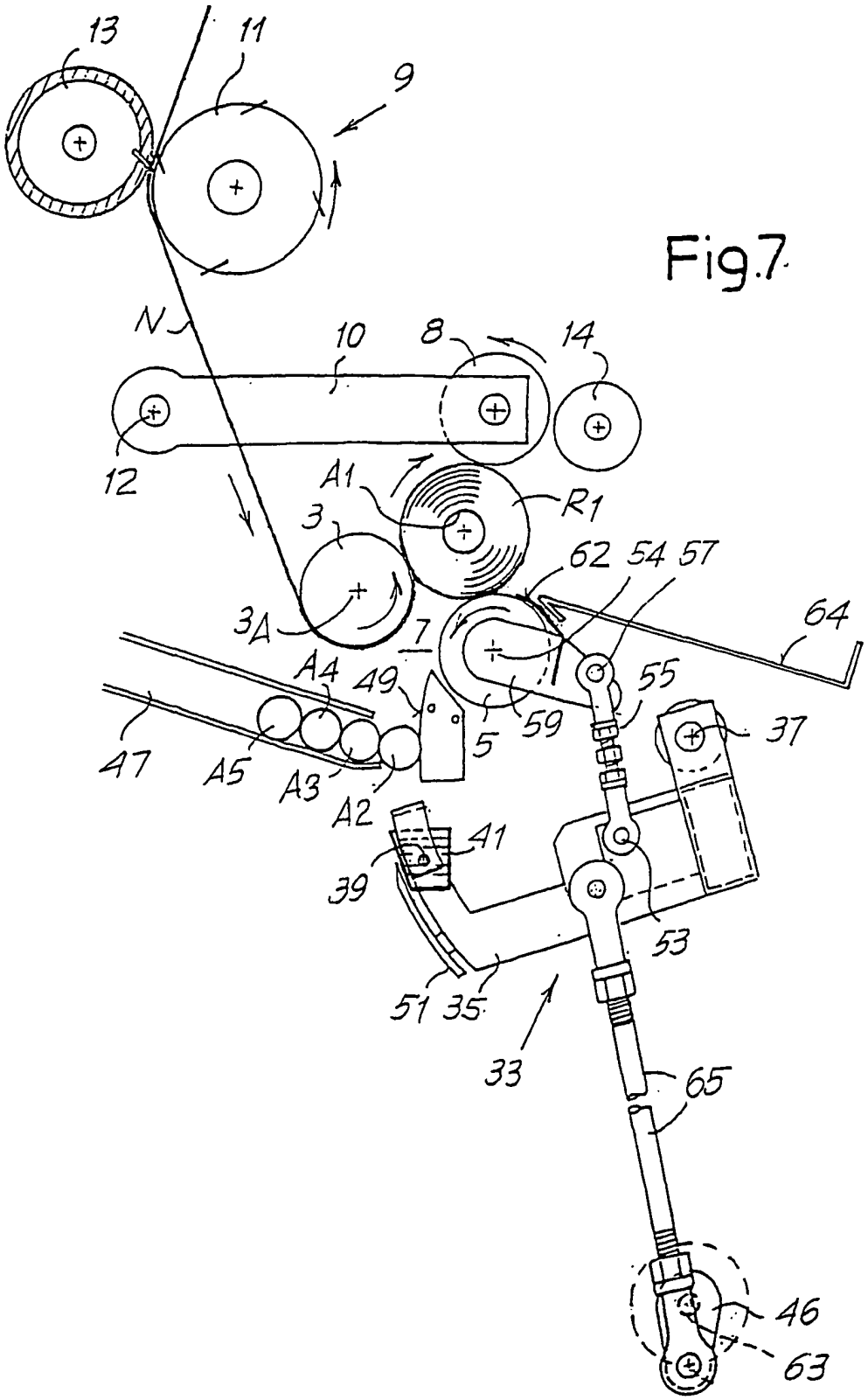
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Fig.7

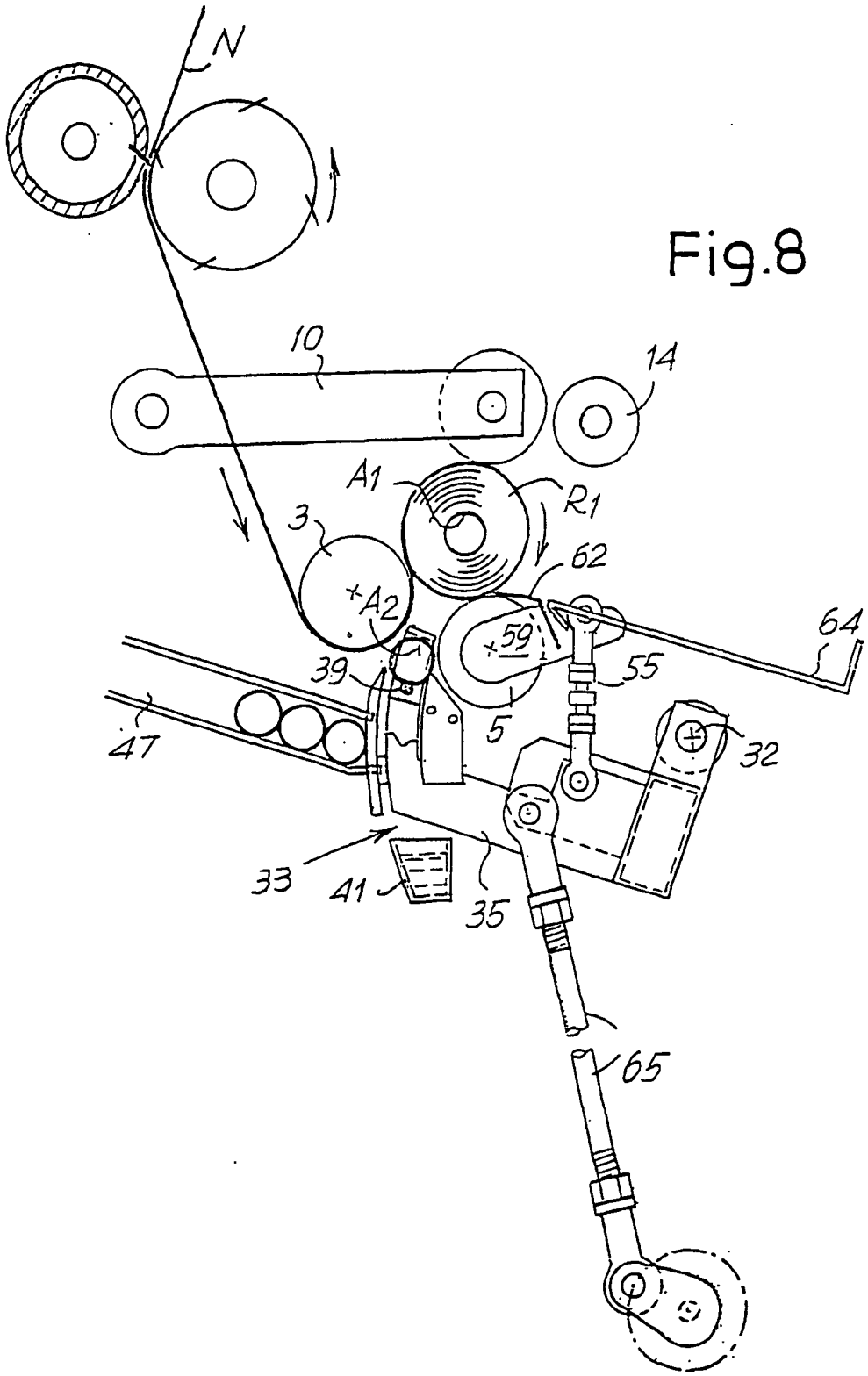


Fig.8

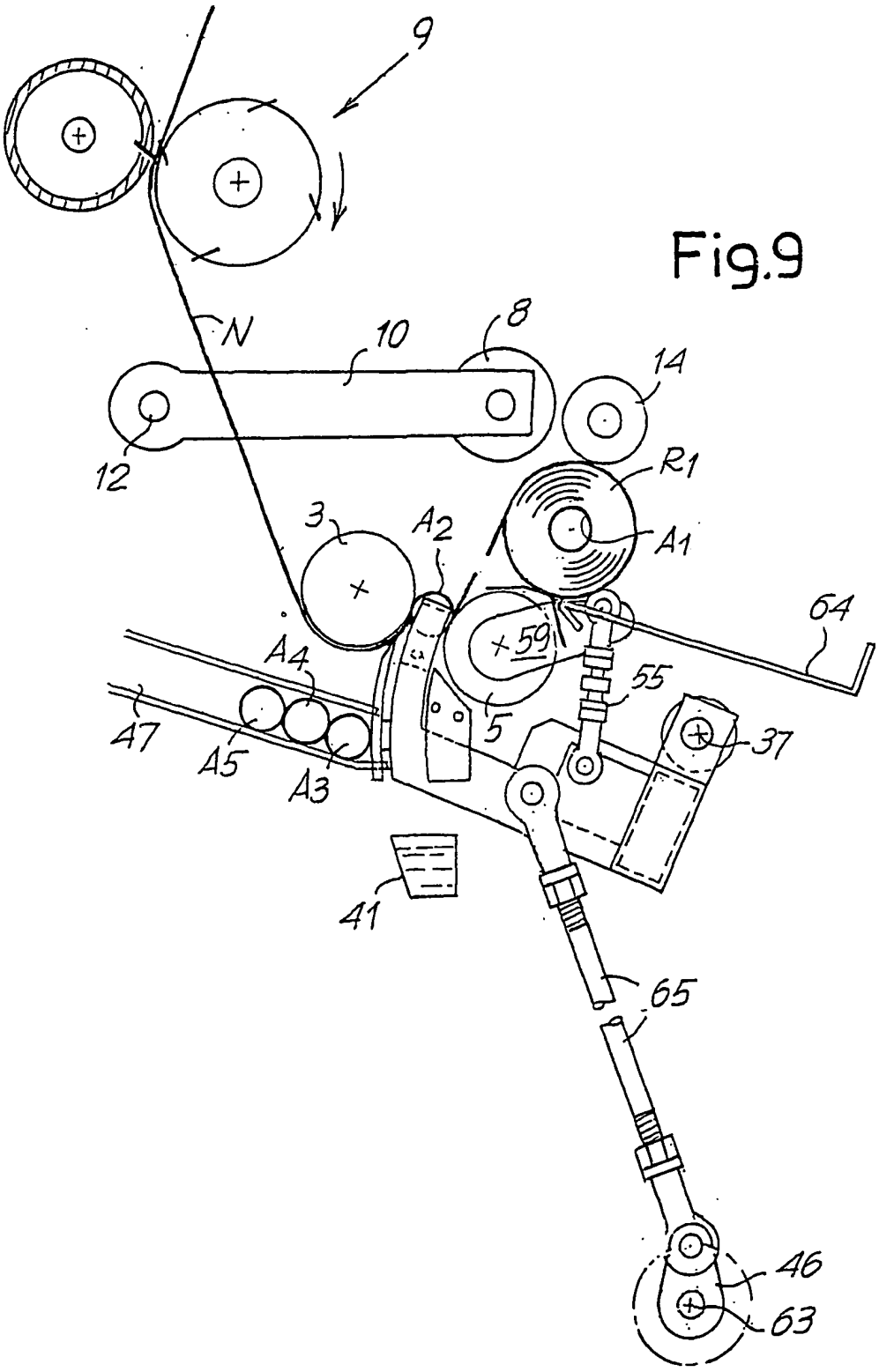


Fig.9

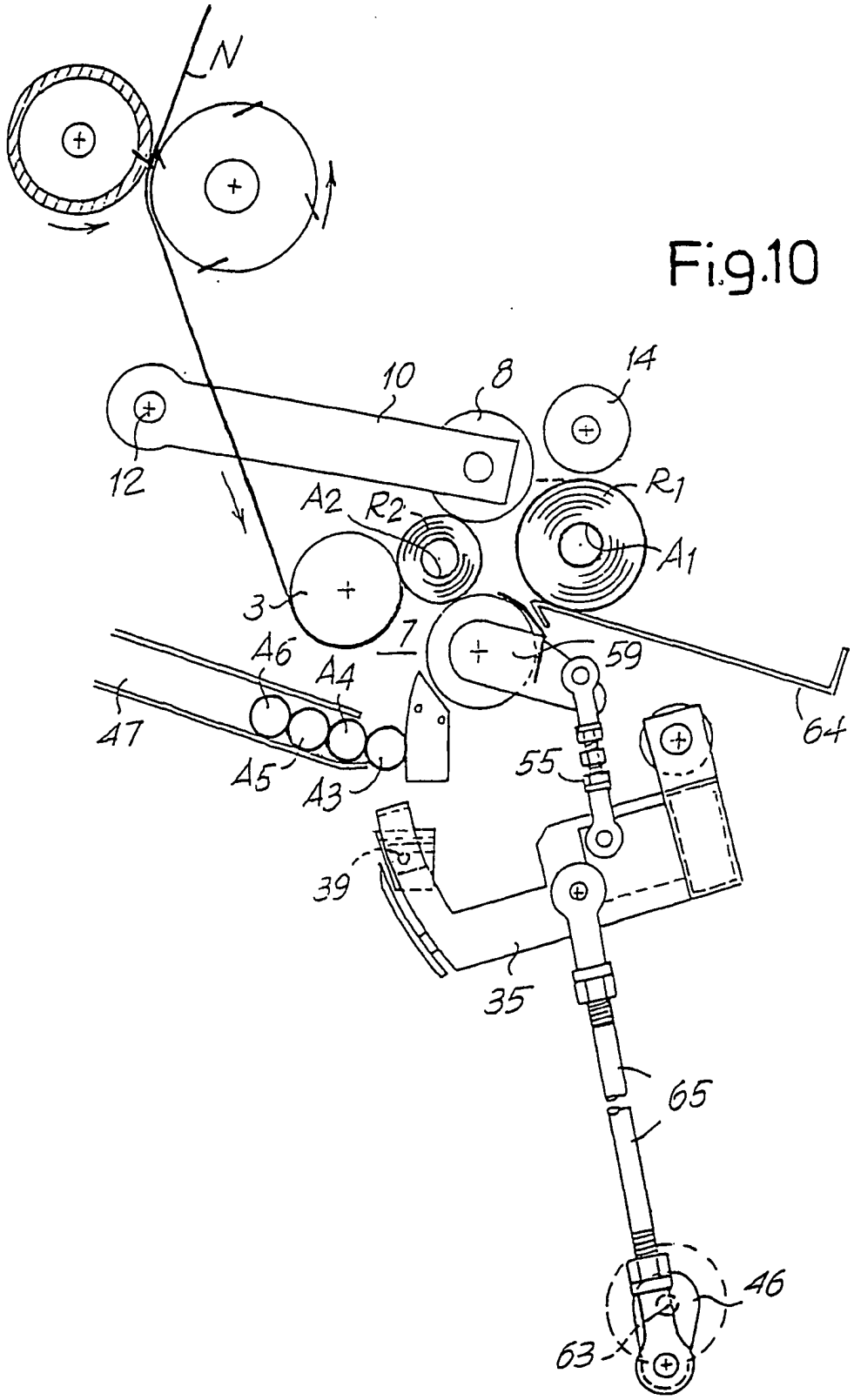


Fig.10

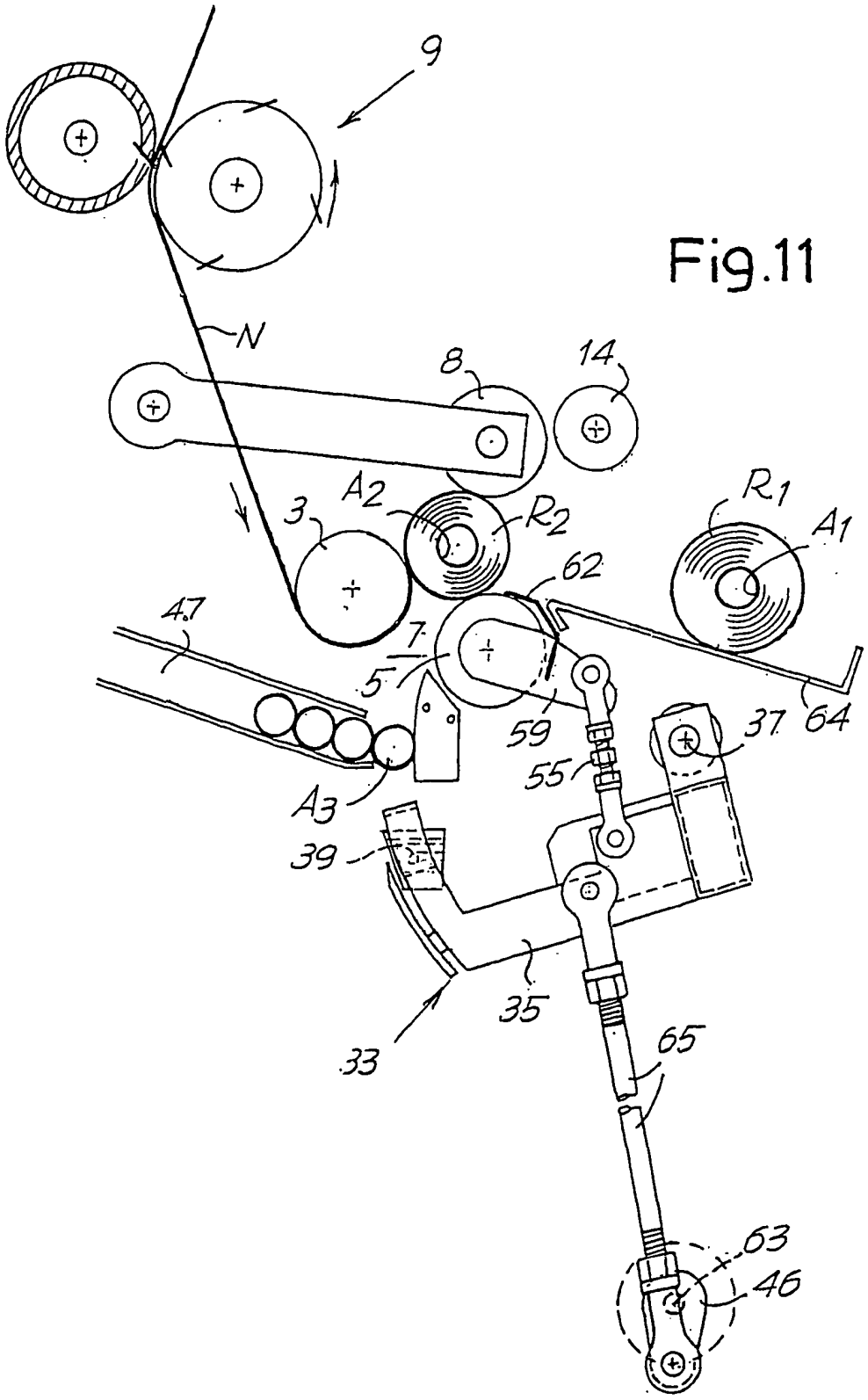


Fig.11

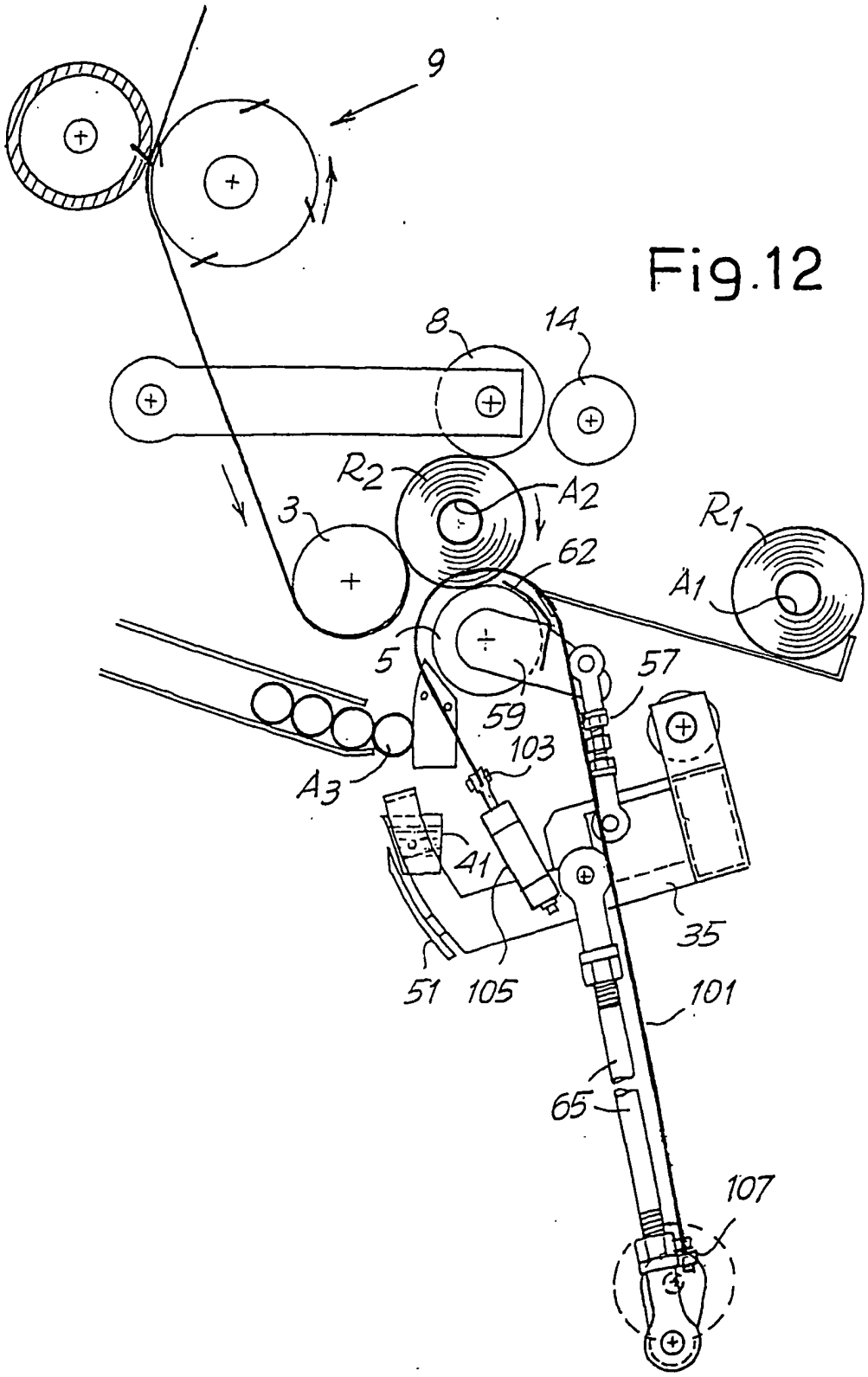
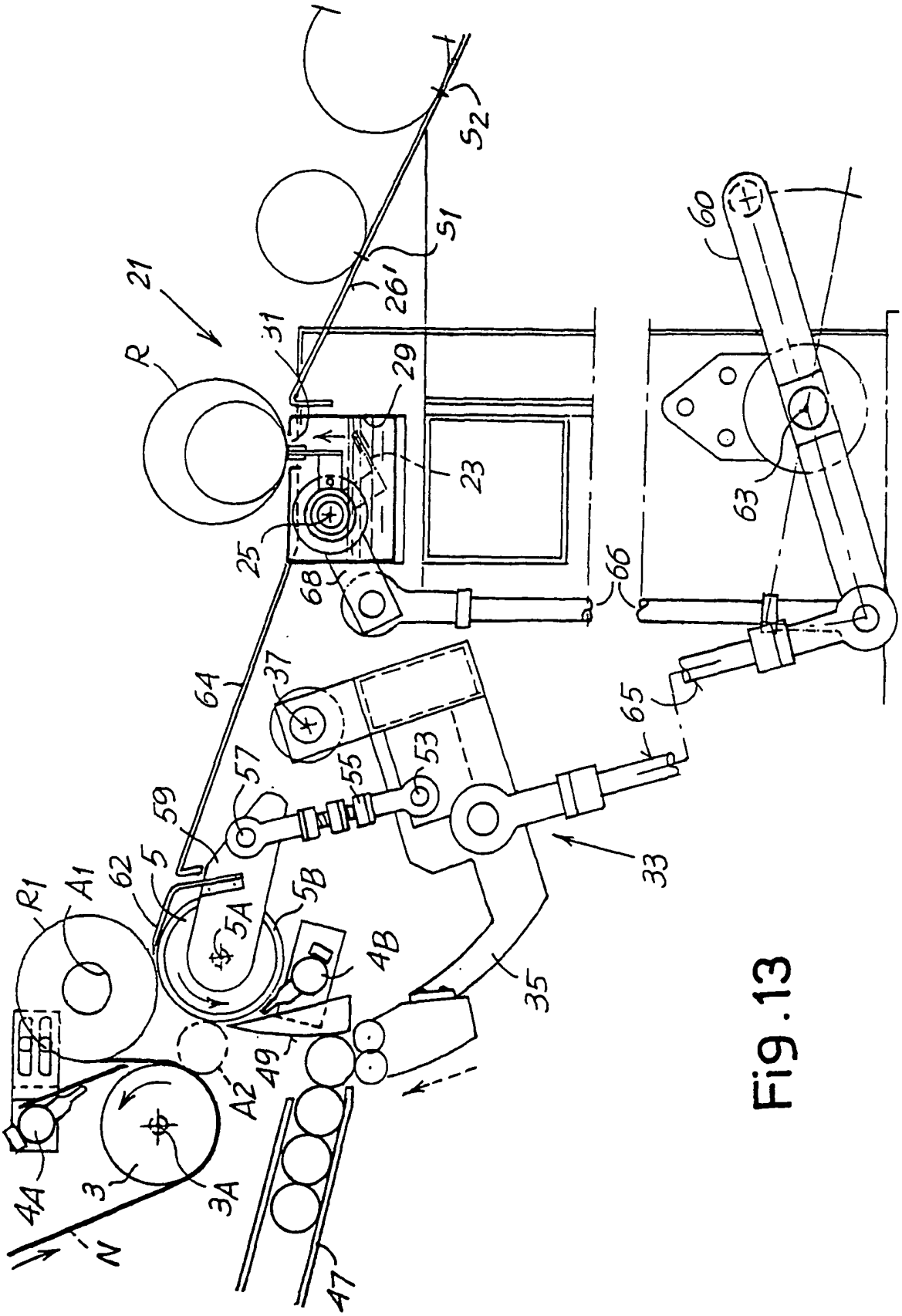


Fig.12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59
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R1
A1
5A
5B
4B
33
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A2
4A
3
3A
N
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Fig.13

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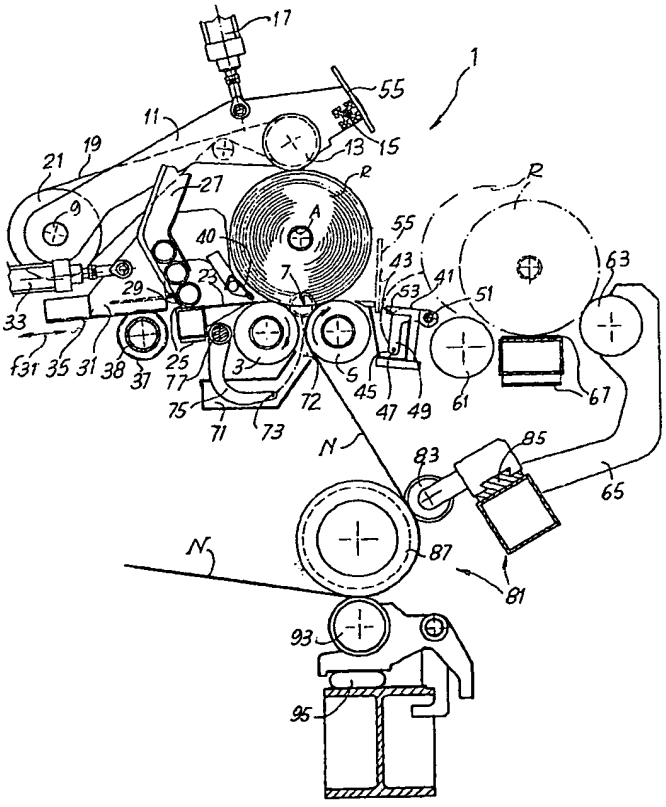
(54) Title: REWINDING MACHINE TO PRODUCE LOGS OF WEB MATERIAL AND RELATIVE WINDING METHOD



(57) Abstract: The machine comprises in combination: a winding cradle (7); an insertion member (29) to insert winding cores (A, A1) into said cradle; an ejector (39) to eject the logs formed from said cradle (7) causing them to roll on an unloading chute (41); a severing device (55, 53) to sever the web material after ejection of the log from said cradle. Disposed along the unloading chute is an aperture (43) elongated in a direction transverse to the direction in which the log is unloaded along said unloading chute. Moreover, the severing device (53, 55) includes a movable element (55) that is inserted into said aperture (43) to cause severing of the web material between the cradle and the finished log.

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Rewinding machine to produce logs of web material and relative winding method

Description

Technical field

The present invention relates to a machine for producing logs of wound web material. More specifically, the invention relates to a rewinding machine of the peripheral type, that is wherein a log of web material is formed in a cradle defined by members in contact with the periphery of the log being formed. These members are typically constituted by winding rollers.

More specifically, the invention relates to a rewinding machine with discontinuous, that is start-stop, operation. In these machines the web material is fed continuously in the winding cradle until completion of the log. At this point the feed speed of the web material is reduced or feed is stopped, to allow unloading of the finished log, insertion of a new winding core and cutting of the web material, as well as adhesion of the leading edge produced by cutting or severing the web material to the new winding core.

The invention also relates to a winding method to produce logs of web material wound around central winding cores.

State of the art

To produce logs of paper, non-woven and other web materials, rewinding machines are used wherein the log being formed is in contact with the winding rollers that transmit the rotatory motion to the log. In particular, winding machines of the start-stop type are used to produce logs with relatively large diameters, especially for limited production quantities. Examples of machines of this type are described in WO-A-9902439 (equivalent to US patent N. 6.129.304) and in US patent N. 4.422.588.

WO-A-9902439 describes a rewinding machine of the start-stop type comprising in combination:

- a first winding roller and a second winding roller defining a supporting and winding cradle for a log being formed;
- an insertion member to insert winding cores into said cradle;
- an ejector to eject the formed logs from said cradle causing them to roll on an unloading chute;
- a severing device to sever the web material upon termination of winding

each log, after the log has been ejected from said cradle.

Upon termination of winding a log the web material is cut and a glue is applied parallel to the edge of the trailing edge by means of a nozzle that translates in a direction parallel to the direction of the winding axis of the log. The nozzle to apply the glue to the trailing edge of the log is carried by a carriage that translates parallel to the axis of the winding rollers of the rewinding machine and that carries a second nozzle to apply a glue to a new winding core which is inserted into the winding cradle. Application of the glue is a thus a particularly lengthy operation, especially when the web material treated by the machine is of considerable width. In addition to the two nozzles, the carriage also carries a cutting blade to cut the web material crosswise. The translation speed of the carriage is therefore also limited by the need to perform this crosswise cutting operation in a reliable way.

In WO-A-9902439 winding is performed simultaneously on a series of tubular winding cores aligned with one another, cutting the web material into strips of the desired width before said material is wound into a log. However, winding may be performed on a single tubular core or on a single spindle, i.e. of approximately the same length as the width of the web material to be wound.

Hereinafter, reference will be made in general to a log being formed, this being intended as a single log wound on a single winding core, or a series of smaller logs (that is, with a reduced axial length) wound simultaneously on a plurality of cores aligned with one another.

Objects and summary of the invention

The object of the present invention is to provide a rewinding machine, especially of the start-stop type, which is particularly efficient and overcomes specific drawbacks of traditional machines and in particular allows the production cycle to be speeded up.

The object of a preferred embodiment of the invention is to provide a rewinding machine that can wind the web material with the same efficiency on a single core or on several aligned cores, after cutting the web material longitudinally into strips.

Essentially, according to a first aspect of the invention, a peripheral rewinding machine of the start-stop type is provided, wherein:

- disposed along the chute to unload the log from the winding core is an

aperture which extends in a direction transverse to the direction in which the log is unloaded along said unloading chute;

- and said severing device comprises a movable element that is inserted into said aperture to cause severing of the web material between the cradle and the finished log.

In this way upon termination of winding the log the web material is cut extremely rapidly by inserting the movable element into the transverse aperture provided on the unloading chute. This makes it possible, for example, to start winding a new log before the trailing edge of the just completed log has been sealed and for gluing of the latter to take place during winding of the new log.

According to a particularly advantageous embodiment of the invention, a first glue container can be disposed underneath the elongated transverse aperture provided on the unloading chute of the logs; associated with this is a first movable dispensing member that collects the glue from the container to apply it to the finished log ejected from the winding cradle.

Winding means may also advantageously be provided to wind the trailing edge of the log after the glue has been applied; these can define a stop position of the ejected log on said unloading chute, in which position the glue is applied.

According to a particularly advantageous embodiment of the invention, to guarantee fail safe severing of the web material and reliable and fail safe operation of the severing device, in addition to the movable element, this device includes a blade fitted along the aperture provided on the unloading chute of the log, with which the movable element cooperates. The blade may be a serrated blade. Although it is possible for the blade to be provided on the movable element, positioning of a fixed blade along the edge of the aperture makes the machine safer. Moreover, to obtain even more reliable operation, the blade may be associated with the edge of the transverse aperture downstream with respect to the log unloading direction. In this way, there is no risk of the web material not being cut and remaining unbroken and being partially unwound from the formed log by following the movement of the movable element.

In a modified embodiment, the movable element is provided with resilient pressure strips arranged on the two sides of a rigid member, such as a blade. The pressure strips pinch the web material against the edges of the elongated aperture during web severing, while the rigid member enters the aperture and

cuts or tears the web. The fixed blade along the edge of the aperture can be dispensed with in this case.

Advantageously, the width of the aperture, that is its dimension in the direction in which the logs are unloaded, is such that when the movable element of the severing device is in said aperture, the first movable dispensing member can pass through said aperture. In this way the movements of the members required to cut or sever the web material and to glue the log may overlap in time to reduce the duration of the operating cycle.

In a particularly advantageous embodiment of the invention, the movable element of the device to sever the web material is carried by a pair of oscillating arms. These arms may in turn support a third winding roller, which thus has a movable axis so that it can rise gradually during winding of the log being formed in the winding cradle and move away from the log to allow unloading upon termination of winding. This roller may be motorized. This layout reduces the number of movable members of the machine, reducing the cost and making it simpler and consequently more reliable.

According to a different embodiment of the invention, the movable element of the device to sever the web material is carried by a pair of oscillating arms different from the oscillating arms which support said third winding roller. As will be explained in more detail later on, this arrangement allows the movement of the severing device to be independent of the movement of the third roller. This can be useful when it is required to handle cores of various differing diameters with the same machine.

In a preferred and improved embodiment of the rewinding machine according to the invention, disposed underneath the winding cradle is a second glue container, associated to which is a second movable dispensing member, to apply a glue to the winding cores when they are located in the cradle.

To insert the winding cores into the winding cradle, disposed on the opposite side of said cradle with respect to the unloading chute for the finished logs is a winding core supporting surface, said insertion member pushing the winding cores from said surface into said cradle.

To produce a simpler structure and reduce the number of actuators required to control the movements of the various members of the machine, according to a preferred embodiment of the invention, the ejector and the

insertion member are integral with each other so that they can be controlled by a single actuator. For example, the ejector can be formed of a pair of sides between which a pusher section extends to eject the finished logs from the winding cradle, and with which the insertion member is integral, the ejector and the insertion member being spaced from each other in the direction of the movement to insert the cores and to eject the logs. In this case it is also possible to provide means to feed the cores to place said cores in an intermediate position between the insertion member and the ejector when they are in a withdrawn position.

These feeding means may have various configurations according to the type of winding to be obtained. For example, when winding is performed on a single tubular core or on a single spindle of a length essentially equal to the width of the web material to be wound, the winding cores or spindles can be inserted along a channel that extends above the supporting surface for the winding cores. Feed takes place in this case by dropping the cores from a container overhead. When, on the other hand, winding is performed after having cut the web material longitudinally, on a plurality of winding cores aligned with one another in the axial direction, these cores must be inserted in a specific position on the supporting surface. For this purpose a conveyor belt may for example be provided to feed the cores in a direction parallel to their axis and therefore orthogonal to the direction of feed of the web material in the rewinding machine.

The two feed systems may both be provided on the same machine, so that it can work alternately in one mode or in the other.

In an advantageous embodiment both the first and the second movable glue dispensing members to apply glue respectively to the finished log and to the new winding core(s) inserted into the winding cradle have an elongated element provided with an oscillating movement.

When the rewinding machine is produced to wind several strips of web material simultaneously around winding cores aligned with one another in the axial direction, a plurality of cutting knives are advantageously provided to cut the web material along longitudinal cutting lines, cooperating with respective counter-blades constituted by a plurality of annular channels produced on a counter-roller. Advantageously, in this case a series of ply-bonding members,

cooperating with said counter-roller, may be provided. In this way a single element – that is the counter-roller – performs the dual function of counter-blade for the cutting knives and counter-pressure member for the ply-bonding wheels. This configuration of the longitudinal cutting members to divide the web material into strips and ply-bonding members can be adopted in rewinding machines differing from the one forming the object of the present invention and in general also in machines of other types, each time a web material requires to be divided into strips, where the web material is composed of two or more plies which must be bonded with one another by ply-bonding.

According to a different aspect, the present invention relates to a method to produce logs of web material, comprising the steps of:

- inserting a first winding core into a winding cradle formed by a pair of winding rollers;
- winding a pre-determined quantity of web material around said at least one winding core to form a log;
- unloading the log formed from said winding cradle along an unloading chute;
- inserting a second winding core into said cradle;
- severing the web material between said log and said second winding core by means of a severing device;

and wherein:

- arranged along said unloading chute is an aperture extending in a direction transverse to the direction in which the log is unloaded along said unloading chute
- a first glue container is disposed underneath said aperture;
- said web material is severed by a movable element of said severing device, inserting said movable element into said aperture;
- a glue is applied to the log unloaded on said unloading chute by means of a first movable dispensing member that collects glue from said first container.

Further advantageous characteristics and embodiments of the rewinding machine and of the winding method according to the present invention are indicated in the appended claims.

Brief description of the drawings

The invention will now be better understood by following the description and accompanying drawing, which shows a non-limiting practical embodiment of the invention. More specifically, in the drawing:

Figure 1 shows a schematic side view of the main elements of the rewinding machine according to the invention;

Figures 2 to 10 show a sequence of operating steps of the rewinding machine;

Figure 11 shows a longitudinal section of the counter-roller;

Figures 12A-12E show a sequence of operating steps of a second embodiment of the rewinding machine according to the invention; and

Figures 13A and 13B show an enlargement of the web severing means in of said second embodiment.

Detailed description of the preferred embodiment of the invention

Referring first to Figure 1, the rewinding machine (shown generically at 1) is comprised of a first winding roller 3 and a second winding roller 5 which define a winding cradle 7. The winding rollers 3, 5 are disposed with parallel axes and at a distance such that the nip between them has a smaller dimension than the minimum diameter of the winding core usable with this machine. In this way the winding core (single or multiple) or the winding spindle is inserted from above and supported on the pair of rollers without going through the nip between them.

A pair of oscillating arms 11 carrying a third winding roller 13, with its axis parallel to the axes of the winding rollers 3, 5, are hinged around an axis of oscillation 9. The oscillating arms 11 are connected to each other by a crosspiece 15 and their oscillation is caused by the increase in the diameter of the log being formed and, upon termination of winding, is controlled by an actuator, for example a piston-cylinder actuator, 17. The third winding roller 13 is made to rotate by means of a belt 19 that takes its movement from a pulley 21 in turn motorized by a motor (not shown), which may be the same one that operates the two winding rollers 3, 5.

An essentially flat surface 23, to support the winding cores to be inserted into the winding cradle 7, is disposed on the left of the winding cradle 7 (observing Figure 1). The cores can be carried to the surface 23 by means of a belt conveyor 25 (shown in a cross section in Figure 1), which inserts one or

more cores aligned with one another with a transverse movement parallel to the axis of said cores. Alternatively, the winding cores may be carried to the surface 23 by making them drop by gravity along a channel 27 positioned above, wherein said cores are inserted from a container (not shown), for example a hopper. The transverse dimension of the channel 27 may be adjusted to insert winding cores with diameters of various dimensions.

To insert the winding cores (carried by one or by the other insertion means to the surface 23) into the winding cradle 7 an insertion member 29 is provided, comprising a transverse section integral with a pair of sides 31 parallel with each other. The two sides 31 are provided with a translatory movement according to the double arrow f31, controlled by a piston-cylinder actuator 33, connected to one of the two sides 31, the movement being transmitted to the other side with a system comprising racks 35 and pinions 37 and a torsion bar 38.

A further section 39 is integral with the two sides 31, parallel to the section 29, which forms part of an ejector that ejects the completed logs of web material from the winding cradle 7.

A discontinuous unloading surface 41 is disposed on the opposed side of the cradle 7 with respect to the surface 23. Along the unloading surface 41 on which the logs formed and unloaded from the winding cradle 7 roll, a transverse aperture 43 is provided, extending approximately for the entire width of the surface in the direction orthogonal to the plane in Figure 1. Disposed underneath the unloading surface 41 is a glue container 45, inside which a movable dispensing member is positioned, comprising an elongated element 47 constituted by a bar or by a wire or another similar element, extending orthogonal to the plane of Figure 1 and carried by a pair of oscillating arms 49. The movable dispensing member formed of the wire 47 can oscillate around an oscillation axis 51 to be carried out of the aperture 43 until it touches the surface of a log positioned in the gluing position as shown with the dashed line in Figure 1 and as shall be better described hereunder with reference to the sequence illustrated in Figures 2 to 10.

A blade 53, advantageously a serrated blade, is applied along the longitudinal edge of the aperture 43 farthest from the winding cradle 7 (that is downstream with respect to the movement of the log unloaded from the winding

cradle) for the purposes to be clarified hereunder.

A movable element 55 is connected to the pair of oscillating arms 11, along the crosspiece 15 that joins them; this element cooperates with the aperture 43 and with the blade 53 penetrating the aperture 43 in the way to be described hereunder, to perform cutting or severing of the web material upon termination of winding each log.

The log that is in the gluing position is held there by a pair of rollers 61, 63. The first of these has a fixed axis while the second is carried by movable arms 65, the oscillation of which allows the log to be unloaded onto a conveyor belt 67 disposed in an intermediate position between the rollers 61 and 63, when the roller 63 is disposed in its lowered position. One or both of the rollers 61 and 63 are motorized, to rotate the finished log located in the gluing position for the purposes described hereunder.

A second glue container 71 is disposed underneath the winding roller 3 with an aperture 72 disposed approximately at the winding cradle 7, underneath the nip formed by the winding rollers 3, 5. A second dispensing element 73 carried by a pair of arms 75 oscillating around an oscillation axis 77 is immersed in the container 71. The conformation of the arms 75 and the position of the axis of oscillation 77 are such that the oscillating movement of the elongated element 73 (which as in the case of the element 47 may be a wire, a bar or the like, extending orthogonal to the plane of Figure 1) make the element pass through the nip between the winding rollers 3, 5 and emerge in the winding cradle 7 to touch the winding core(s) supported on it. This allows the glue to be transferred to the downward facing surface of the winding core(s) ready to start a winding cycle.

A cutting and ply-bonding unit indicated as a whole with 81, is disposed along the path of the web material N, which is wound around the winding roller 5. This unit comprises a series of disk-shaped knives 83 positioned crosswise along a guide 85, in order to position any number of knives along the width of the web material and in the desired position. These cooperate with a counter-roller with the conformation shown in Figure 11. This is provided with a series of annular grooves 89 relatively close to one another. For example the grooves 89 (which may be a few millimeters and typically 3-7 mm in width) are spaced by annular projections 91 of the same width as, or slightly wider than, the actual

grooves. Knurled ply-bonding wheels 93, pushed at high pressure against the counter-roller 84 by means of inflatable plenum chambers 95 are disposed in an angularly staggered position, for example of around 120°, with respect to the position of the knives 83, along the periphery of the counter-roller 87. The high pressure exerted by the wheels 93 on the annular projections 91 of the counter-roller 87 causes the plies (for example two or more) forming the web material N to bond through ply-bonding. The wheels 93 and the plenum chamber 95 may be produced for example as described in the US patent N. 5.433.817.

Operation of the rewinding machine described hereinbefore is clearly illustrated in the sequence in Figures 2 to 10 to which reference shall now be made.

In Figure 2 a log R in the completion phase of winding around a tubular core A is positioned in the winding cradle 7. As mentioned, the log may actually be formed of a plurality of rolls which are axially aligned and wound on winding cores aligned with one another. Upon termination of winding, the oscillating arms 11 are lifted according to the arrow f11 to remove the third winding roller 13 from the completed log and allow it to be ejected from the winding cradle 7.

A new winding core A1, or a series of winding cores aligned with one another, has been carried to the surface 23, by means of the channel 27 or the conveyor belt 25. The movable glue dispensing members are both immersed in the respective containers 45 and 71.

In Figure 3 a movement from left to right of the sides 31 with the sections 29 and 39 integral with them has caused insertion of the new core(s) A1 into the winding cradle 7 and ejection of the formed log R that rolls on the surface 41 to the gluing position defined by the rollers 61 and 63. The rolling movement of the log on the surface 41 is in the direction to cause partial unwinding of the last portion of web material wound on the log. Therefore, a length of web material that is still integral and must be cut extends between the new core inserted in the winding cradle 7 and the finished log which is now in the gluing position. Feed of the web material towards the winding rollers has been interrupted.

In the subsequent Figure 4 the sides 31 have been returned to the initial position to remove the section 39 from the winding cradle 7. In this way the pair of oscillating arms 11 with the roller 13 and the movable element 55 carried by them can be made to oscillate downwards. The oscillating movement brings the

winding roller 13 into contact with the new core A1 in the winding cradle and the movable element 55 is inserted into the aperture 43 in the unloading surface 41, as shown in Figure 5. This movement to insert the movable element 55 into the aperture 43 causes severing or cutting of the web material which, due to rolling of the log R formed from the winding cradle 7 to the gluing position, is unwound from the winding roller 5 to the roller 61. The web material is thus severed through the effect of cooperation between the movable element 55 and the serrated blade 53.

In Figure 6 the glue dispenser 73 has been raised to apply a strip of glue to the core A1 (or to the aligned cores) in the winding cradle 7. Subsequently, the glue dispenser 73 is lowered again and the winding rollers 3, 5, 7 start to rotate counter-clockwise to cause rotation of the core A1 in the winding cradle 7 and consequently feed of the web material around the core. The web material nipped between the winding roller 5 and the new core A1 adheres to the latter through the effect of the glue applied. The portion of web material between the movable element 55 that performed the cut of the web material and the core A1 is wound around the new core.

The distance between the movable element 55 inserted into the aperture 43 and the serrated blade 53 can be such to allow the elongated element 47 of the first glue dispenser to pass between the former two members. In this way the elongated element 47 of the first glue dispensing member can already be lifted from the glue container 45 when the machine is in the position in Figure 7.

Nonetheless, in the example shown this movement to list the elongated element 47 of the first glue dispenser is performed after the new log being formed around the winding core A1 has increased in diameter enough to lift the winding roller 13 and therefore the arms 11 that carry it to an extent that removes the element 55 from the aperture 43, as shown in Figure 8.

At this point the elongated element 47 of the first glue dispenser is removed from the container 45 with an oscillating movement of the arms 49 around the axis 51. The elongated element 47 is made to oscillate clockwise until it touches a certain point of the periphery of the log R which is in the gluing position. The position in which the glue is transferred from the elongated element 47 to the surface of the log R is such that subsequent winding of the trailing edge produced by severing the web material makes the trailing edge

adhere to the log covering the glue.

In Figure 9 the first movable gluing member has been returned to its initial position inside the container 45, while the rollers 61 and 63 are made to rotate clockwise to cause counter-clockwise rotation of the log R in the gluing position and therefore rewinding of the trailing edge of the web material to cover the strip of glue applied to the surface of the log by the elongated element 47.

Finally, while the new log of web material continues to be wound on the new core A1, the previously formed log is carried to the conveyor belt 67 by means of clockwise oscillation of the arm 65 and of the roller carried by it. The conveyor belt removes the log formed and glued from the rewinding machine to allow subsequent treatment of a new log.

Figures 12A-12E and 13A-13B show a modified embodiment of the rewinding machine according to the invention. Similar or equivalent parts and elements are designated with the same reference numbers as in the previous figures. The two main differences of the machine according to this second embodiment are the following.

Firstly, the movable element 55 is supported by a pair of oscillating arms 11, which pivot about axis 9, but which do not support movable roller 13. The latter is supported by an auxiliary pair of oscillating arms 11A, pivoted about the same axis 9, even though the pivoting axes for arms 11 and 11A might be different. As will become apparent from the sequence of steps depicted in Figures 12A-12E, this allows the oscillation movement of the winding roller 13 to be independent from the movement of the movable severing element 55. For example, comparing Figures 12C and 12D, it can be seen that the movable element 55 has been raised after web severing while the roller 13 with the respective arms 11A is still in the lower position. Separating the movement of movable element 55 and roller 13 provides more operating flexibility, even though it increases the structural complexity of the machine to some extent. It could be useful, e.g. when cores of variable diameters are to be used. In this case if a single pair of oscillating arms were used to support the roller 13 and the movable element 55, severing of the web material N might be obtained for small diameter cores but not when large diameter cores are used, because the movable element 55 would then not be able to reach the proper severing position. By adopting independent oscillating arms 11, 11A this limitation is

avoided.

The second difference vis-à-vis the previous embodiment is in the structure of the elongated aperture 43 provided along chute 41. In this case, the aperture 43 into which the movable element 55 penetrates to cut or sever the web material N is separate from a different aperture 43A which is provided, parallel to aperture 43, to allow the passage of the movable glue dispensing member 47. While the aperture 43 is in the form of a channel, i.e. it does not extend across the thickness of the chute 41, the aperture 43A extends across the whole thickness of the chute 41 to provide a passage for said dispensing member 47.

A serrated blade similar to blade 53 could be arranged along one of the edges of aperture 47. In the depicted embodiment, however, further difference is to be seen in the shape of the movable element 55. While in the previous embodiment the lower portion of the movable element 55 was substantially in the form of a blade, which co-acts with the fixed serrated blade 53, somewhat in a scissors fashion, in the embodiment of Figures 12A-12E, 13A, 13B the movable element 55 is provided with a rigid element 58 extending in a direction orthogonal to the web material, and provided with two pressing strips 56 made of resilient material, such as rubber. These strips might be hollow to become more yieldable. The strips 56 project downwards farther than rigid member 58.

As can easily be appreciated from Figures 13A, 13B, during cutting the strips 56, contact the web material N prior to the contact thereof by rigid member 58. The web material N is thus pressed against the surface of the chute 41 (Fig.13A) and blocked. By further lowering the movable member 55 the strips 56 are compressed and the rigid member 58 enters the aperture or slot 43, thus cutting or tearing the web material N.

The various features which distinguish this second embodiment from the previous one can be variously combined. For example, the particular shape of the web severing device can be used also in the embodiment of Figures 1-11, or the dual oscillating arm arrangement 11, 11A of Figures. 12A-12E could be used in conjunction with the structure of the movable element 55 as depicted in Figures 1-11.

It is understood that the drawing purely shows a possible embodiment of the invention, the forms and layouts of which may vary without however

departing from the scope of the concept on which the invention is based. The presence of any reference numbers in the appended claims has the sole purpose of facilitating their reading in the light of the description hereinbefore and of the accompanying drawings and does not limit the scope of protection.

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Claims

1. Rewinding machine to produce logs of web material (N), comprising:

- a winding cradle (7);
- an insertion member (29) to insert winding cores (A, A1) into said cradle;
- an ejector (39) to eject the logs formed from said cradle (7) causing them to roll on an unloading chute (41);
- a severing device (55, 53) to sever the web material after the log is ejected from said cradle;

characterized in that:

- disposed along the unloading chute is an aperture (43) elongated in a direction transverse to the direction in which the log is unloaded along said unloading chute;
- and said severing device (53, 55) comprises a movable element (55) that is inserted into said aperture (43) to cause severing of the web material between the cradle and the finished log.

2. Rewinding machine as claimed in claim 1, characterized in that said severing device also comprises a blade (53) applied along said aperture (43) with which said movable element (55) cooperates.

3. Rewinding machine as claimed in claim 2, characterized in that said blade (53) is fitted along the edge of said aperture disposed downstream with respect to a movement to unload the log on said chute (41).

4. Rewinding machine as claimed in claim 2 or 3, characterized in that said blade (53) is serrated.

5. Rewinding machine as claimed in one or more of the previous claims, characterized in that a first glue container (45) is disposed underneath said chute (41) and in that a first movable dispensing member (47, 49) that collects the glue from said first container (45) to apply it to the finished log is associated with said first glue container.

6. Rewinding machine as claimed in claim 5, characterized in that it comprises rewinding means (61, 63) to wind the trailing edge of the log after the glue has been applied.

7. Rewinding machine as claimed in claim 6, characterized in that said rewinding means define a stop position of the log ejected onto said

unloading chute (41), the glue being applied to the log when it is in said stop position.

8. Rewinding machine as claimed in claim 5, characterized in that the width of said aperture, in the direction in which said logs are unloaded, is such that when the movable element (55) of the severing device is in said aperture, said first movable dispensing member (47) can pass through said aperture.

9. Rewinding machine as claimed in one or more of claims 5 to 8, characterized in that said movable element (55) is carried by a pair of oscillating arms (11).

10. Rewinding machine as claimed in claim 9, characterized in that said pair of oscillating arms (11) support a winding roller (13) with movable axis.

11. Rewinding machine as claimed in one or more of the previous claims, characterized in that a second glue container (71) is disposed underneath said cradle (7) and in that a second movable dispensing member (73, 75), to apply a glue to the winding cores when they are in said cradle, is associated with said second glue container.

12. Rewinding machine as claimed in one or more of the previous claims, characterized in that an insertion surface (23) for the winding cores (A, A1) is disposed on the opposed side of said cradle with respect to the unloading chute (41), said insertion member (29) pushing the winding cores along said insertion surface (23) towards said cradle.

13. Rewinding machine as claimed in one or more of the previous claims, characterized in that said ejector (39) and said insertion member (29) are integral with each other.

14. Rewinding machine as claimed in claim 12 or 13, characterized in that said insertion member (29) is provided with a translatory movement.

15. Rewinding machine as claimed in at least claims 12 and 13, characterized in that: said ejector comprises a pair of sides (31) between which a pusher section extends to eject the finished logs from said cradle (7), and with which the insertion member (101) is integral, the ejector and the insertion member being spaced from each other in the direction of the movement to insert the cores and to eject the logs, and in that means to feed the cores are provided to position said cores in an intermediate position between the insertion member and the ejector.

16. Rewinding machine as claimed in claim 15, characterized in that said means to feed the cores comprise a channel (27) to drop the cores, defining an insertion trajectory orthogonal to the axis of said cores.

17. Rewinding machine as claimed in claim 15 or 16, characterized in that said means to feed the cores comprise a conveyor (25) that inserts said cores with a movement parallel to the axis of said cores.

18. Rewinding machine as claimed in claim 17, characterized in that said conveyor comprises a belt conveyor.

19. Rewinding machine as claimed in at least claim 5, characterized in that said first movable dispensing member (47, 49) comprises an elongated member (47) provided with an oscillating movement.

20. Rewinding machine as claimed in at least claim 11, characterized in that said second movable dispensing member (73, 75) comprises an elongated member (73) provided with an oscillating movement.

21. Rewinding machine as claimed in at least claim 6, characterized in that said rewinding means include a pair of rewinding rollers (61, 63).

22. Rewinding machine as claimed in claim 21, characterized in that a first of said rewinding rollers is supported by a pair of oscillating arms (65) to be carried from an active position to a disabled position.

23. Rewinding machine as claimed in claim 22, characterized in that a conveyor (67) is disposed between the disabled position of said first rewinding roller (61) and the second of said two rewinding rollers to move the finished logs away in a direction parallel to their axis.

24. Rewinding machine as claimed in one or more of the previous claims, characterized in that it comprises a plurality of cutting knives (83) to cut the web material along longitudinal cutting lines, cooperating with respective counter-blades (91) constituted by a plurality of annular channels (89) produced on a counter-roller (87).

25. Rewinding machine as claimed in claim 24, characterized in that it comprises a series of ply-bonding members (93), cooperating with said counter-roller (87).

26. Rewinding machine as claimed in one or more of the previous claims, characterized in that said winding cradle (7) is formed of a pair of winding rollers (3, 5).

27. Rewinding machine according to one or more of claims 1, 5-26, characterized in that said movable element (55) includes a rigid member (58) and resilient pressing side members (56).

28. Rewinding machine according at least to claim 5, characterized in that said first glue container (45) is arranged underneath said aperture (43).

29. Rewinding machine according to claim 5 or 28, characterized in that said movable dispensing member (47, 49) moves from said first glue container (45) towards said log (R) passing through said aperture (43) into which said movable element (55) enters to sever the web material (N).

30. Rewinding machine according to claim 5 or 28, characterized in that along said chute (41) a second aperture (43A) is provided, arranged parallel to said aperture (43) into which said movable element (55) enters to sever said web material, said second aperture (43A) providing a passage for said first movable glue dispensing member (47, 49).

31. Rewinding machine according to one or more of claims 1-9, 11-30, characterized in that said movable element (55) is carried by a pair of oscillating arms (11) and that a further pair of oscillating arms (11A) is provided, carrying a third winding roller (13).

32. Method to produce logs of web material, comprising the phases of:

- inserting at least a first winding core into a winding cradle (7);
- winding a pre-established quantity of web material (N) around said at least one first winding core (A, A1) to form a log (R);
- unloading the formed log from said winding cradle (7) along an unloading chute (41);
- inserting at least one second winding core (A1) into said cradle (7);
- severing the web material between said log (R) and said at least one second winding core (A1) by means of a severing device;

characterized in that:

- disposed along said unloading chute is an aperture (43), elongated in a direction transverse to the direction in which the log is unloaded along said chute;
- and said web material is severed by a movable element (55) of said severing device, inserting said movable element into said aperture.

33. Method as claimed in claim 32, characterized in that said movable

element (55) cooperates with a blade (53) fitted along said aperture (43) to sever the web material.

34. Method as claimed in claim 32 or 33, characterized in that a movable winding roller (13) is brought into contact with said second core.

35. Method as claimed in claim 34, characterized in that said movable element is moved in said aperture to sever the web material simultaneously to said roller (13) when it is brought into contact with the second core.

36. Method as claimed in one or more of claims 32 to 35, characterized in that a first glue container (45) is disposed underneath said aperture (43); and in that a glue is applied to the log unloaded onto said unloading chute by a first movable dispensing member (47) which collects the glue from said first container.

37. Method as claimed in one or more of claims 32 to 36, characterized in that a glue is applied to said second core when it is in the winding cradle.

38. Method as claimed in claim 37, characterized in that said glue is applied to the second core (A1) during severing of the web material.

39. Method as claimed in claims 37 or 38, characterized in that the glue is applied to the second core by means of a second movable dispensing member (73, 75) that collects glue from a second glue container (71) disposed underneath said winding cradle.

40. Method as claimed in one or more of claims 32 to 39, characterized in that said second core (A1) is disposed at an insertion surface (23) positioned, with respect to the winding cradle, on the opposed side of said unloading chute (41), before unloading the formed log from the cradle.

41. Method as claimed in one or more of claims 32 to 40, characterized in that the formed log is unloaded from said cradle and said second core is inserted into said cradle by means of an ejector and an insertion member integral with each other.

42. Method as claimed in one or more of claims 32 to 41, characterized in that: said web material is formed of at least two plies; in that said at least two plies are bonded together by ply-bonding; and in that the web material is divided into a plurality of longitudinal strips before winding.

43. Method as claimed in claim 42, characterized in that said at least

two plies are bonded and the web material is cut by a series of ply-bonding members (93) and a series of cutting knives (83) cooperating with a single counter-roller (87), which is provided with annular grooves (89) forming counter-blades for said cutting knives, separated from one another by annular projections (91) at least some of which cooperate with said gripping members (93).

44. Method according to claim one or more of claims 32, 34-43, characterized by retaining said web material during cutting by pressing it near the edges of said aperture.

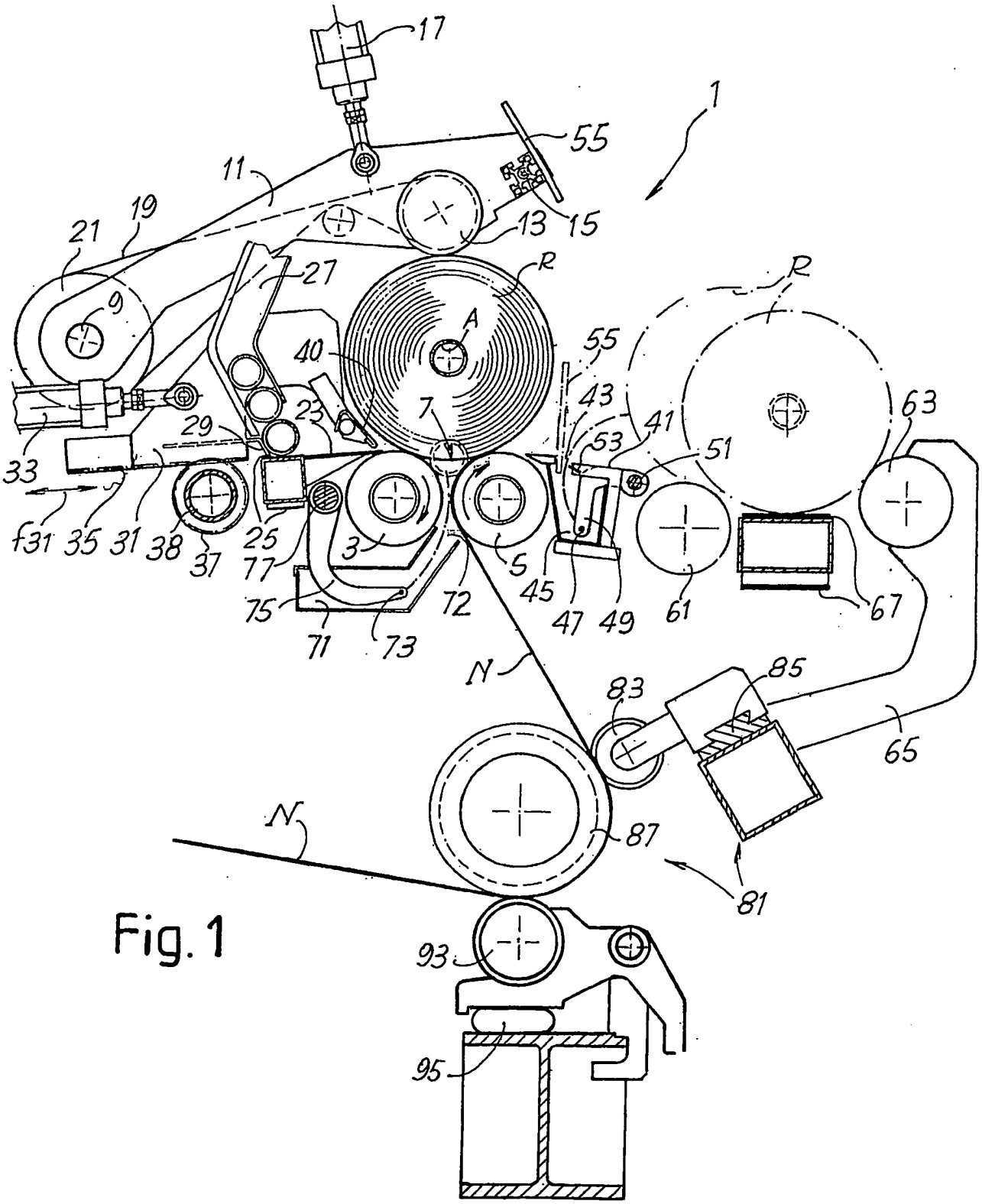
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Fig. 1

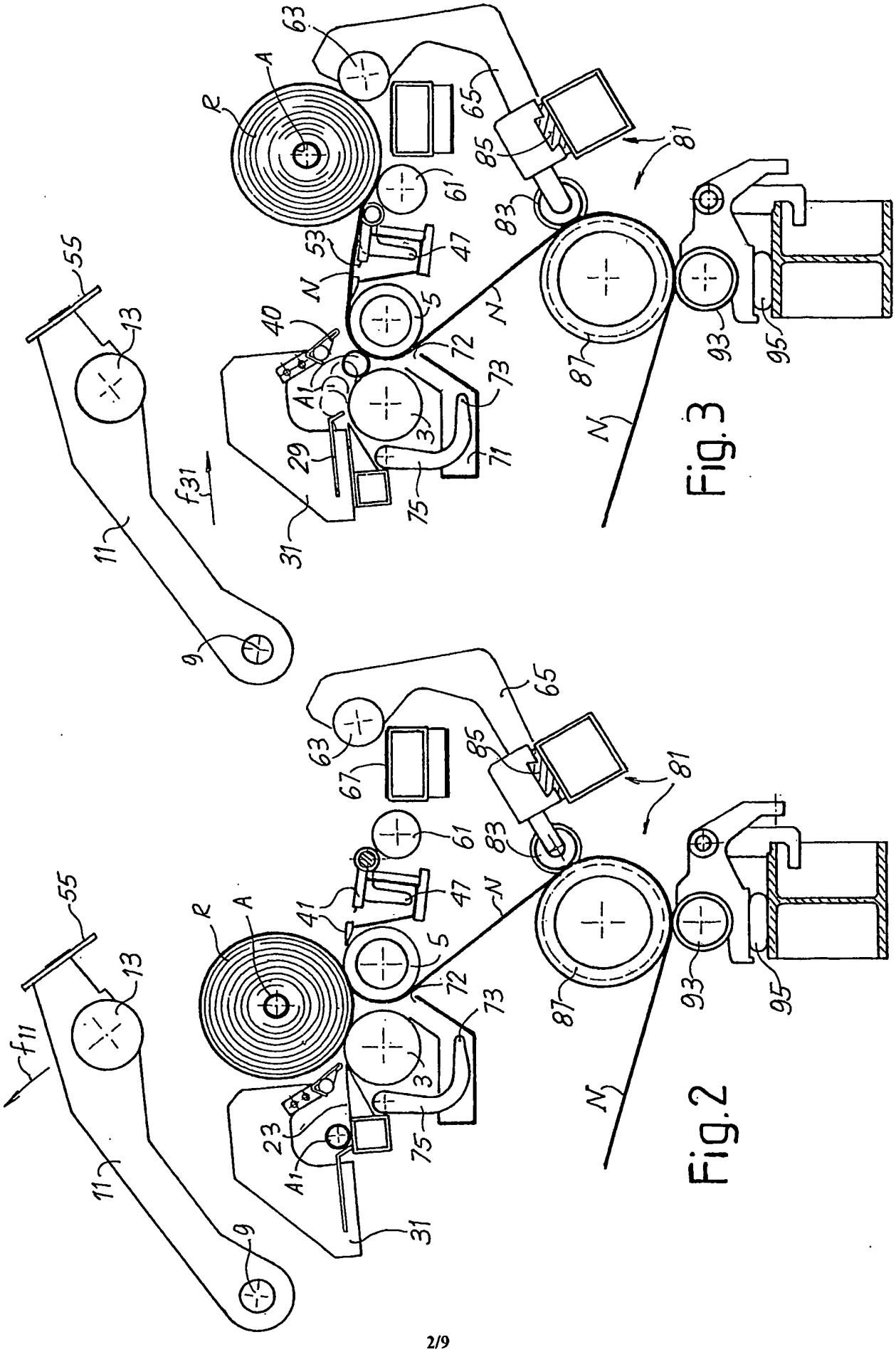
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Fig.3

Fig.2

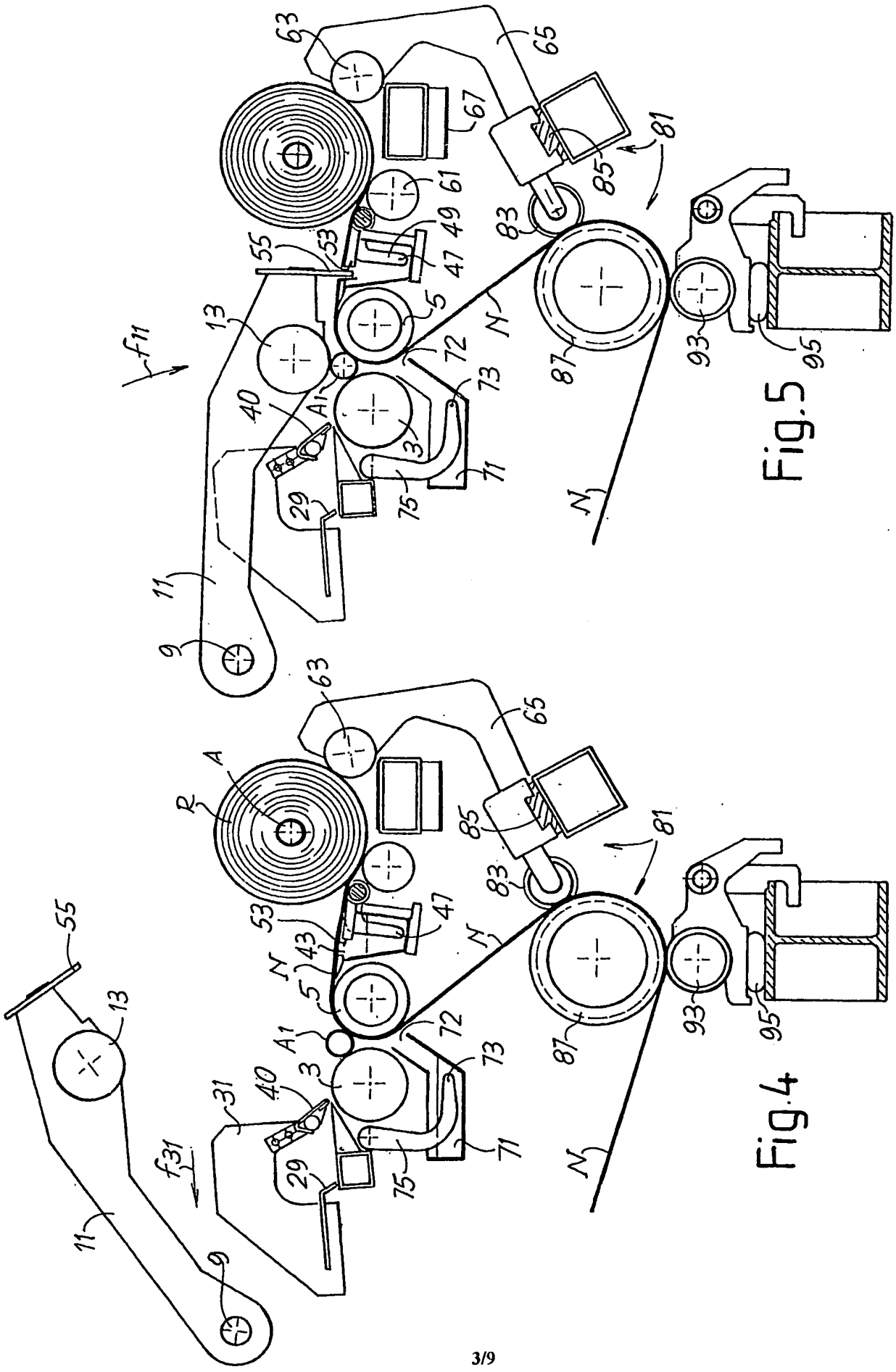
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Fig.5

Fig.4

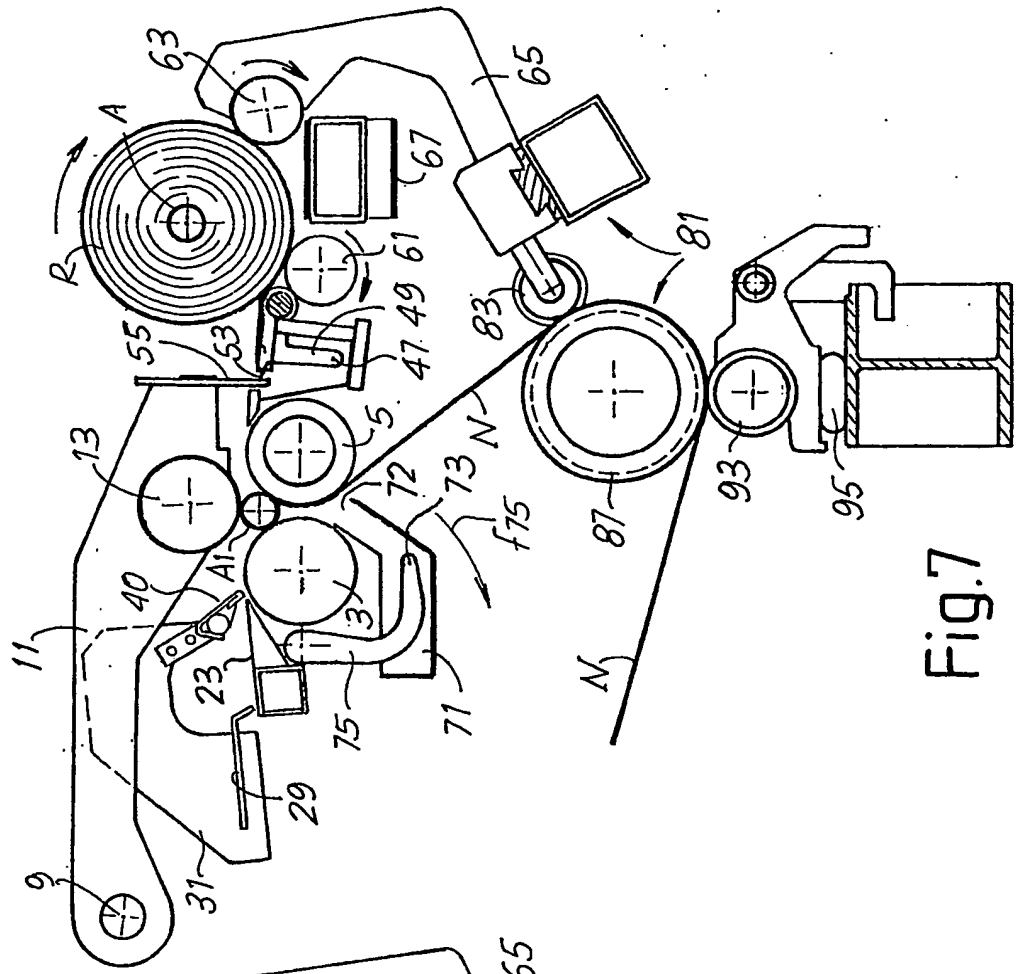
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Fig.7

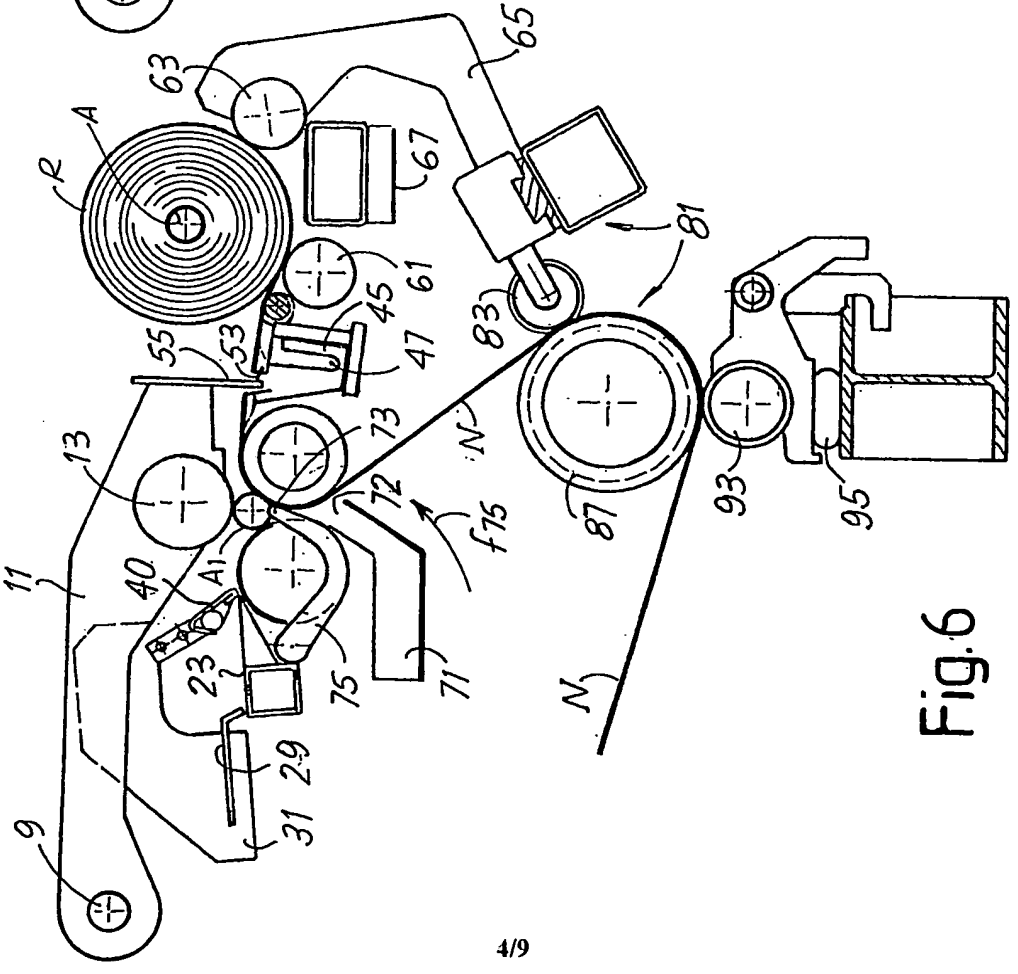
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Fig.6

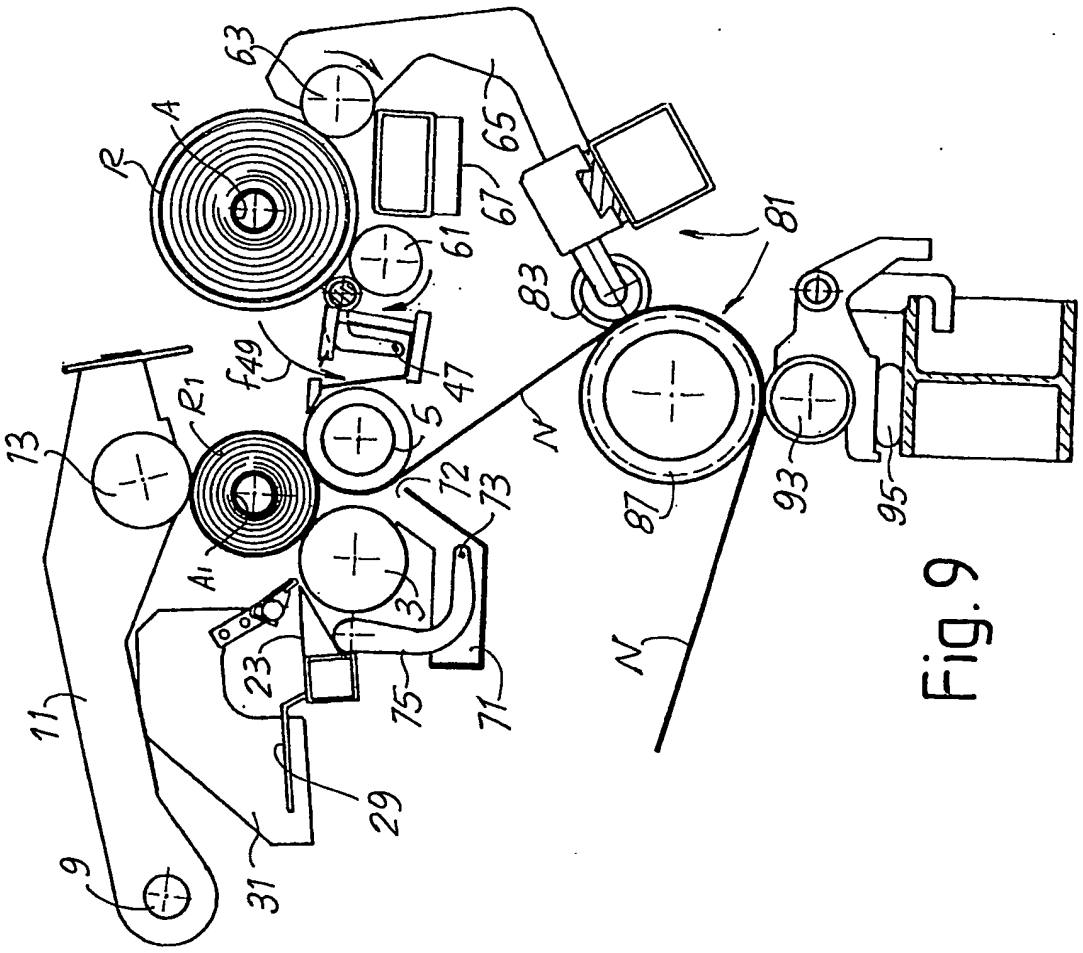
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Fig. 9

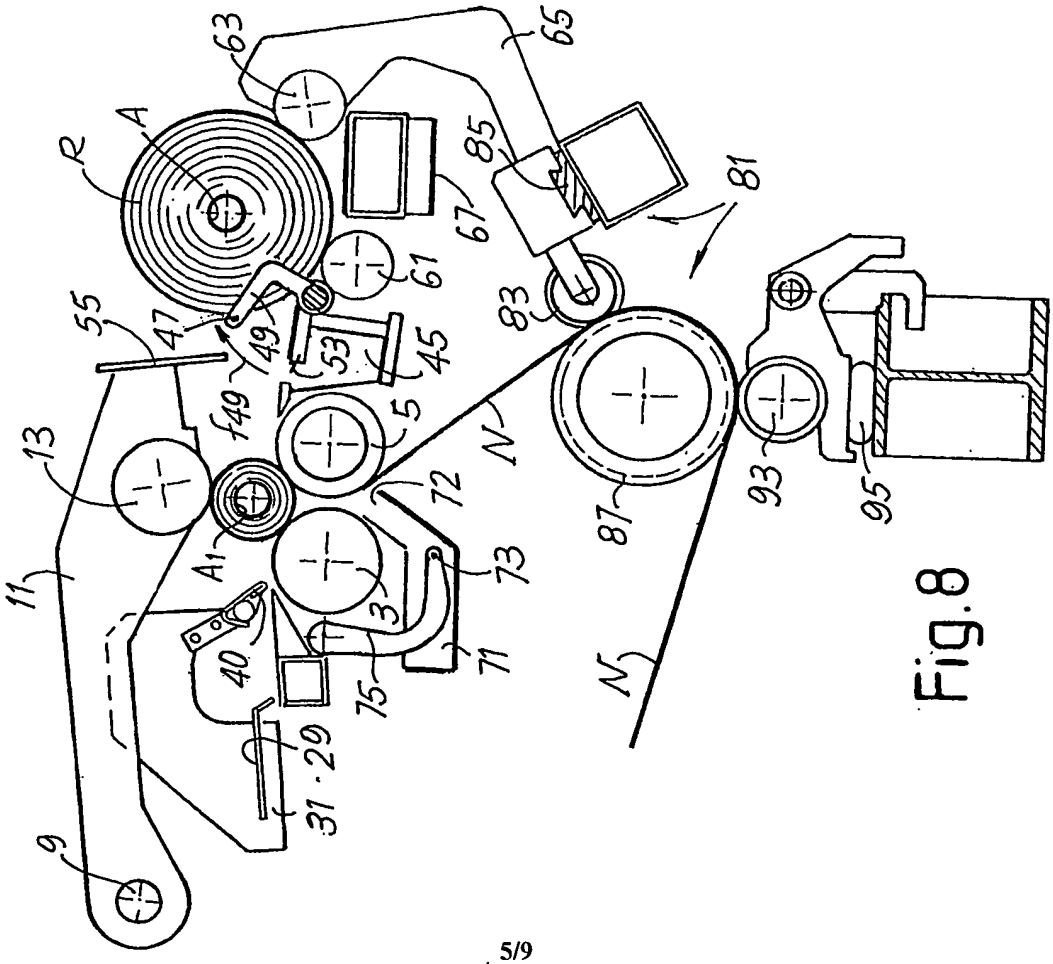
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Fig. 8

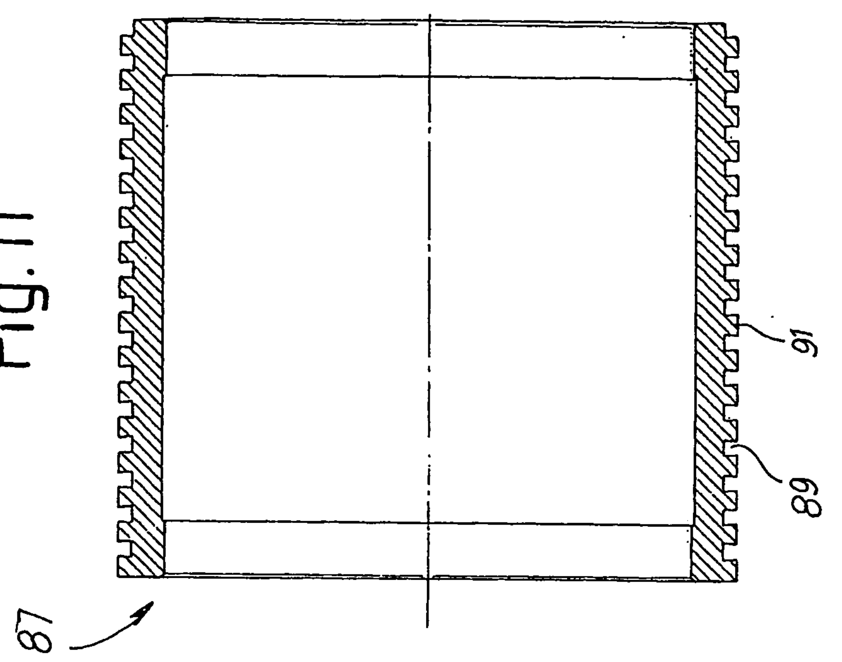
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Fig.11

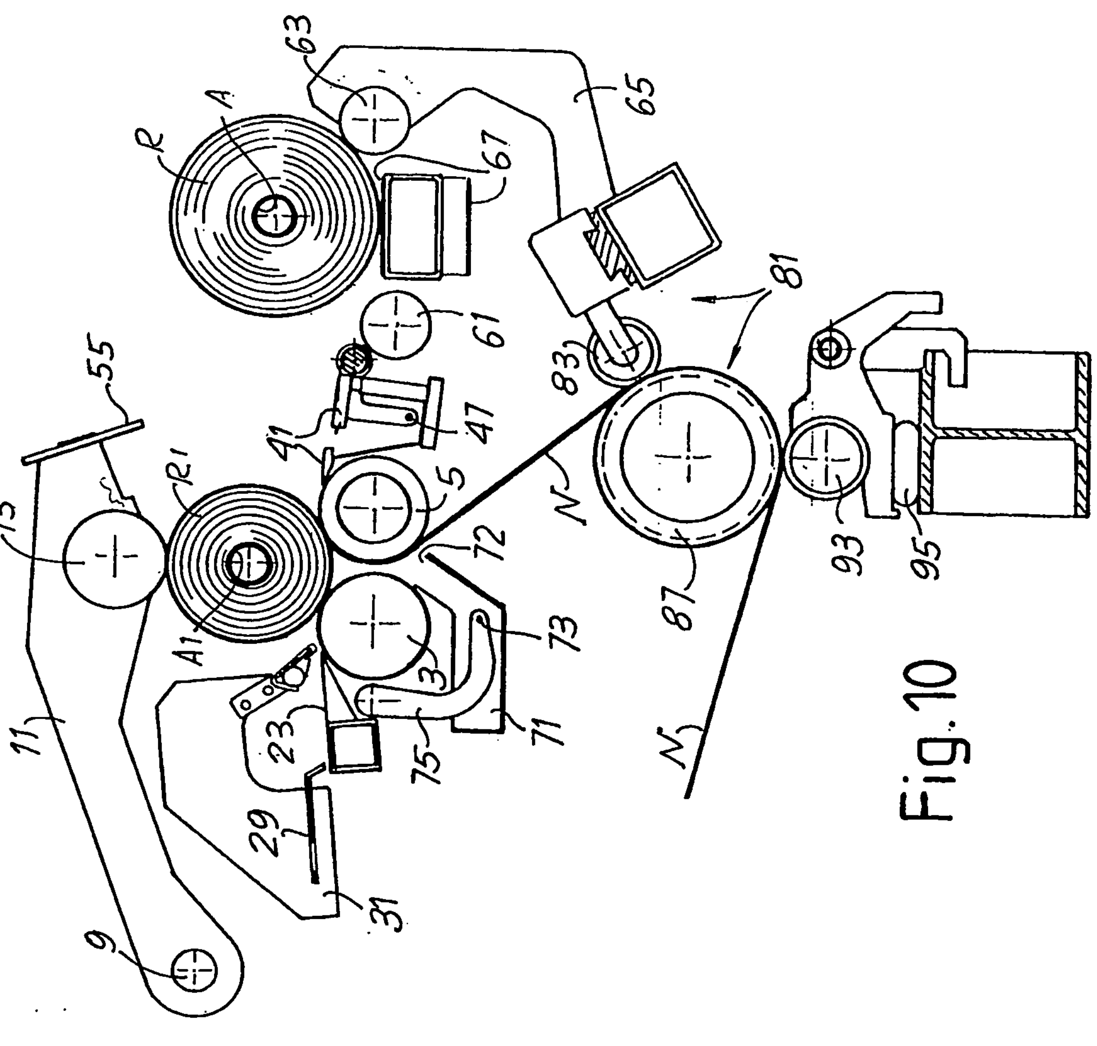
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Fig.10

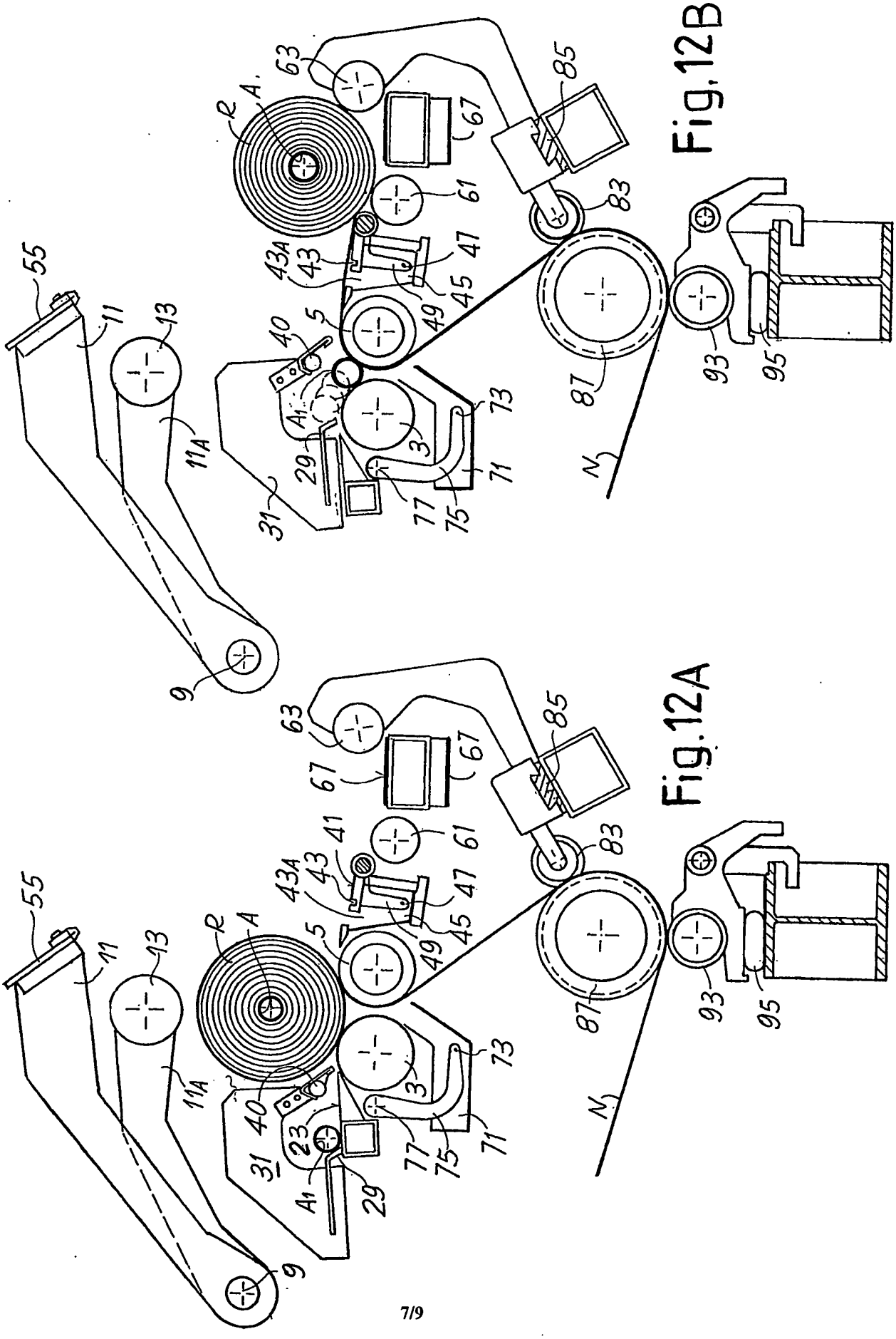

Fig.12A

Fig.12B

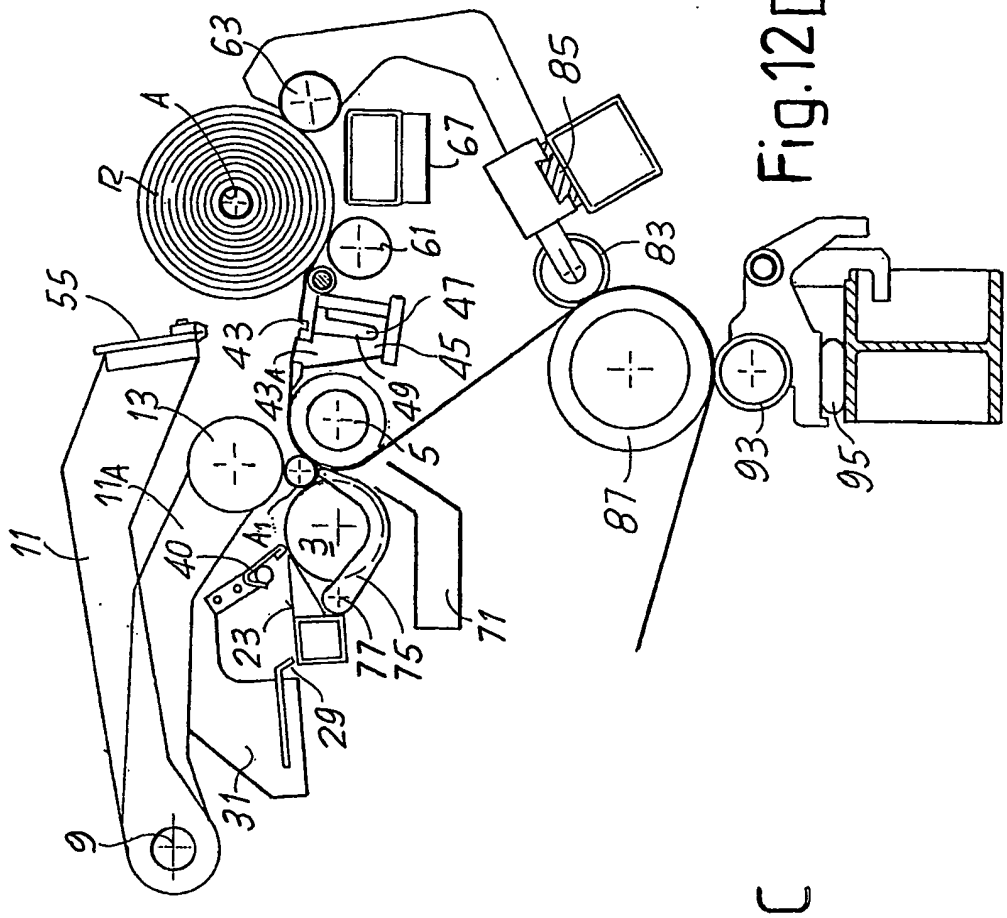

Fig.12D

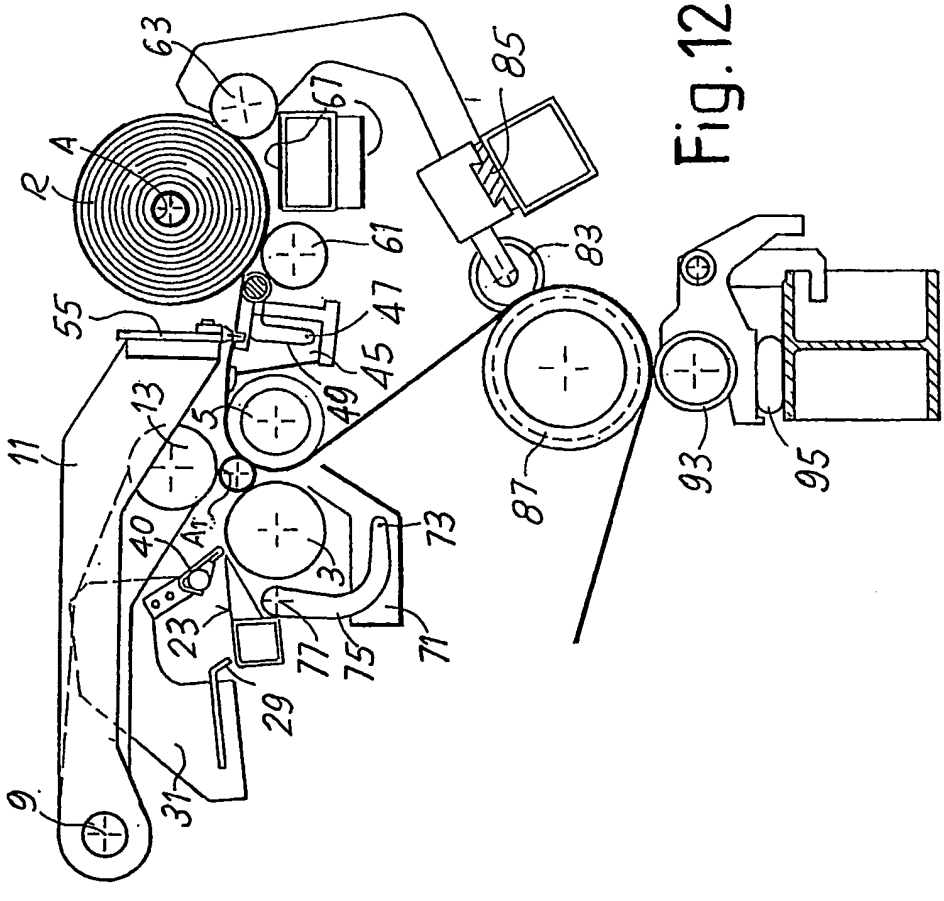

Fig.12C

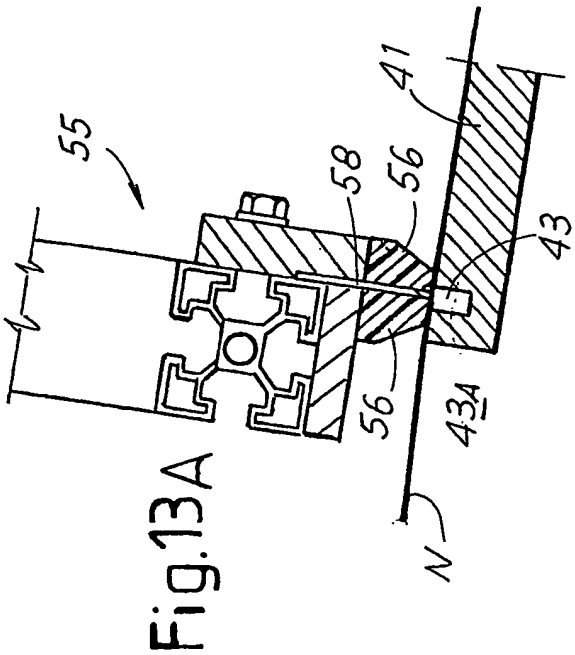

Fig.13A

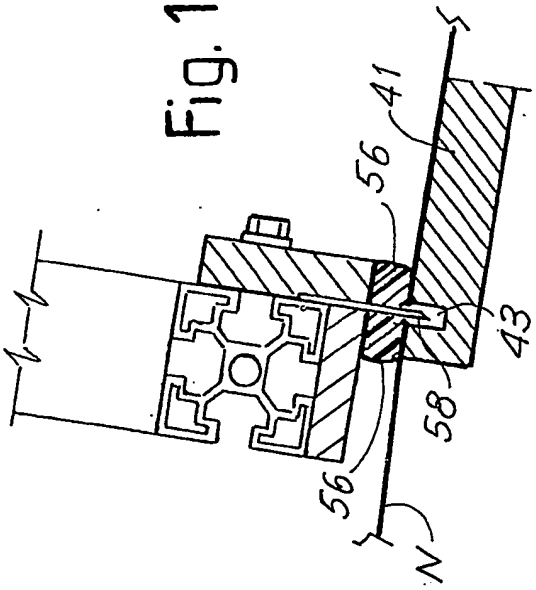

Fig. 13B

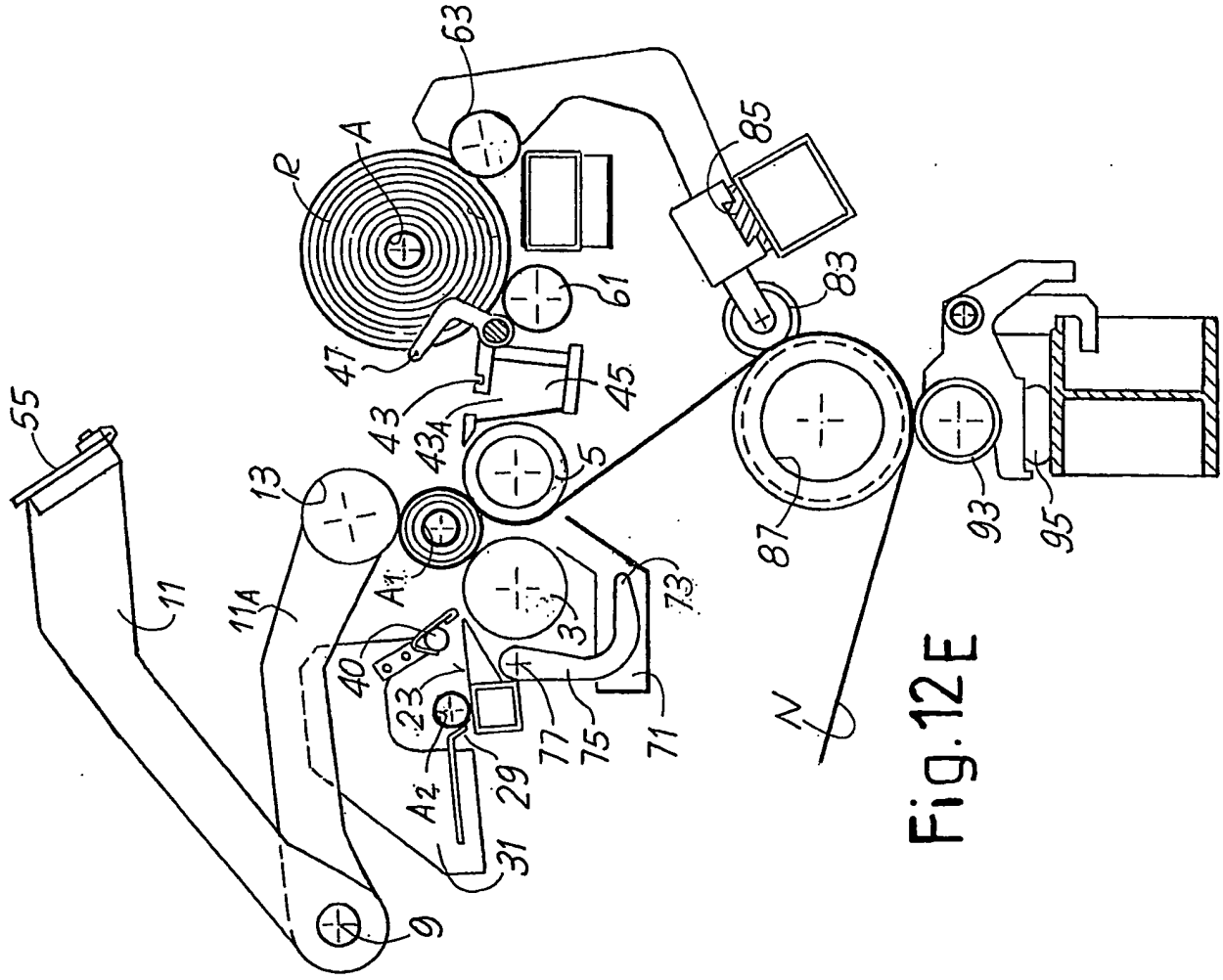

Fig.12E

INTERNATIONAL SEARCH REPORT

Ional Application No
PCT/IT2004/000049

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65H19/22 B65H19/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99/02439 A (BIAGIOTTI GUGLIELMO ;PERINI FABIO SPA (IT)) 21 January 1999 (1999-01-21) cited in the application page 4, line 27 -page 9, line 12; figure 1	1,32
A	EP 0 622 321 A (PERINI FABIO SPA) 2 November 1994 (1994-11-02) column 3, line 37 -column 4, line 1; figures 1-6	1,32
A	US 3 072 353 A (H. W. MOSER) 8 January 1963 (1963-01-08) column 5, line 60 -column 7, line 39; figures 1,4	1,32

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 June 2004	02/07/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Fachin, F

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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